Finis Vitae

“Brain Death” is NOT True Death

The Life Guardian Foundation

To protect and preserve God-given life from its conception to its natural end;
Opposed to the culture of death designed by man.

FINIS VITAE

"Brain Death" is NOT True Death

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Many contributions of Finis Vitae were presented at the Conference entitled
"The Signs of Death" at the Pontifical Academy of Sciences in Vatican City, February 3-4, 2005.
Some contributions have been edited and updated by their authors.
Two contributions by
Dr. Cicero Galli Coimbra are added.

Cover:
Heart illustration by Keith Tucker: www.keithtuckerart.com

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Foreword

Mors est finis vitae: not only is death the biological end of life, but it is al- so the moment when its meaning is disclosed, and with it, also the ultimate purpose of human life. Nevertheless, there has not been on the subject of death the same scientific and cultural debate among public opinion and ex- perts alike, which in recent years, on the other hand, has developed and is still taking place, about the origin of life.

The application of recent scientific and technological developments to medicine have led to new grounds for reflection on death: it is enough here to mention issues such as therapeutic obstinacy, the "biological will," euthanasia and assisted suicide, requests of interruption of treatment, palliative therapies and above all the removal of organs for transplantation purposes. The ideal scenario for those who perform a certain type of explants, such as those con- cerning the human heart, would be to be able to do so on a human being who is still alive. Obviously, this does in turn raise serious moral problems which can be solved only provided we "redefine" the entire concept of death.

In fact up until the 60s, Western judicial and medical tradition believed that the acknowledgement of death should be carried out through the con- firmation of the definitive cessation of all vital functions: that is breathing, blood circulation and activity of the nervous system. In August 1968, an "Ad Hoc" Committee instituted by Harvard Medical School set forth a new cri- terion for the ascertainment of death based on entirely neurological evidence: that is on the definitive cessation of all brain activity, under the definition of "irreversible coma."

Since then the concept of brain death has been incorporated into both legislation and medical practice in most countries in the world. Ever since

the 80s, however, doubts and criticisms have been repeatedly raised within the scientific community on the validity of such definition. The criteria in- troduced by the "Ad Hoc" Committee instituted by Harvard Medical School seem to have lost nowadays both their scientific foundation and ini- tial justification. According to them, in fact, if the encephalon ceases func- tioning, the body becomes nothing more than a mere collection of organs, forsaken and lacking the coordinating centre which would allow the inte- gration among the various functions of the body itself. However, although on a theoretical level what is known as the concept of "central integration" retains a certain attractiveness and can be made object of many and diverse interpretations from a philosophical point of view, medical day by day prac- tice has throughout the years demonstrated a multiplication of episodes in which the irreversible cessation of all brain functions did not bring about al- so the cessation of integrated functioning of a human body, even when in in- tensive care.

Many doubts and questions have also been raised with regards to the neu- rological criteria to be employed for the ascertainment of death. In order to declare a patient with lethal brain injuries dead is it necessary to consider the functioning of the whole encephalon or does a critical system exist within the encephalon which by ceasing its activity can single – handedly determine the dis – integration of the body and, as a consequence, its death?

In a number of countries among which the United Kingdom, doctors who are called upon to ascertain the death of a brain injured patient, only take in- to account the functionality of the encephalic trunk alone, and do not employ any instrumental methods of assessment in order to verify their clinical evalu- ation. On the contrary, in Italy neurological criteria which refers to the func- tionality of the whole encephalon apply and it is compulsory under the law to perform an electroencephalogram on the patient. Why does such an incon- sistency in the nature of neurological criteria applied exist? And furthermore, which set of criteria is the most scientifically appropriate in this case?

Furthermore, other questions can be added to those mentioned above, such as those which derive from medical practice drawing attention to cases of patients who, although answering to the requirements set forth by the neu- rological criteria concerning the entire encephalon, and therefore declared dead but still linked to the reanimation machines while waiting for organ ex- plantation, still retain endocrine – hypothalamic functions as well as those of

neuro-hormonal regulation. Does this mean that those patients were in fact still alive? Should this be the case, it would mean that brain death should be viewed not as the death of a human being, but rather as an irreversible condition, a stage which precedes the authentic death of the individual.

All these, and many other weighty questions of an ethical, juridical and philosophical nature, are investigated in this volume by internationally renowned scholars. A number of these contributions have been presented at the Conference entitled "The Signs of Death" which was promoted by the Pontifical Academy of Sciences and took place in Vatican City on 3-4 Feb- ruary 2005, while others have been written for this publication by European and American doctors, jurists, philosophers.

The significance and the complexity of the subject - matter require an in depth investigation to which we hope also this publication will give a signif- icant contribution.

Roberto de Mattei Vice-President
National Research Council of Italy

The holocaust of abortion and the transplantation of organs from living donors will go down in history as the two most tragic and transcendental events of the last two centuries. Such massacres continue with the protection of the law in the Western countries and the unwavering support of the legal and medical professions.

Over the years, His Holiness John Paul II received extensive correspondence from faithful Catholic physicians who were informing him that the practice of transplanting vital organs is being conducted on living donors. His writings on the subject since 1991 Include the following:

In 1991 Pope John Paul II to a Group on Organ Transplants: "Furthermore, a person can only donate that of which he can deprive himself without serious danger or harm to his own life or personal identity, and for a just and proportionate reason. It is obvious that vital organs can only be donated after death."[i]

Pope John Paul II said to the Participants of the 1989 Pontifical Academy of Sciences: "The problem of the moment of death has serious implications at the practical level, and this aspect is also of great interest to the Church. In practice, there seems to arise a tragic dilemma. On the one hand there is the urgent need to find replacement organs for sick people who would otherwise die or at least would not recover. In other words, it is conceivable that in order to escape certain and imminent death a patient may need to receive an organ which could be provided by another patient, who may be lying next to him in hospital, but about whose death there still remains some doubt. Consequently, in the process there arises the danger of terminating a human life, of definitively disrupting the psychosomatic unity of a person. More precisely, there is a real possibility that the life whose continuation is made unsustainable by the removal of a vital organ may be that of a living person, whereas the respect due to human life absolutely prohibits the direct and positive sacrifice of that life, even though it may be for the benefit of another human being who might be felt to be entitled to preference."[ii]

In the same Address Pope John Paul II stated: "Death can mean decomposition, disintegration, a separation. (cf. *Salvifici Doloris*, n.15; *Gaudium et Spes*, n. 18). It occurs when the spiritual principle which ensures the unity of the individual can no longer exercise its functions in and upon the organism, whose elements left to themselves, disintegrate."[iii] Pope John Paul II stated in *Evangelium Vitae* (n. 15): "Nor can we remain silent in the face of other more furtive, but no less serious and real, forms of euthanasia. These could occur for example when, in order to increase the availability of organs for transplants, organs are removed without respecting objective and adequate criteria which verify the death of the donor."[iv]

His Holiness John Paul II for the Eleventh World Day of the Sick (Washington D.C., U.S.A., February 11, 2003) included:

Professional work should be done in a genuine witness to charity, bearing in mind that life is a gift from God, and man merely its steward and guardian.

4. This truth should be continuously repeated in the context of scientific progress and advances in medical techniques which seek to assist and improve the quality of human life. Indeed, it remains a fundamental precept that life is to be protected and defended, from its conception to its natural end.

As I stated in my Apostolic Letter *Novo Millennio Ineunte*,
«The service of humanity leads us to insist, in season and out of season, that those using the latest advances of science, especially in the field of biotechnology, must never disregard fundamental ethical requirements by invoking a questionable solidarity which eventually leads to discriminating between one life and another and ignoring the dignity which belongs to every human being» (No. 51).

> The Church, which is open to genuine scientific and technological progress, values the effort and sacrifice of those who with dedication and professionalism help to improve the quality of the service rendered to the sick, respecting their inviolable dignity. Every therapeutic procedure, all experimentation and every transplant must take into account this fundamental truth. Thus it is never licit to kill one human being in order to save another.

Finally, in 2004 His Holiness requested that a group of faithful lay leaders collaborate with the Pontifical Academy of Sciences to revisit, once again and study in depth the subjects of "brain death" and vital organ transplantation, since they had previously held official meetings on the subject in 1985 and 1989. However, those conferences were riddled with scientists and physicians who were either involved in the marketing of human organs or were sympathetic to the cause. Some of the participants did not fully understand the subject and went with the flow, not realizing the consequences of their inaction. Only one philosopher, Josef Seifert remained as the voice crying in the wilderness.

As we began to collaborate with the Academy and put forth our selection of experts which encompassed physicians, scientists, philosophers and theologians, we realized that there was strong opposition to those who were in line with the teachings of the Catholic Church and had a history of battling the transplantation of organs from living donors and the well organized marketing of human organs. Little did we know that even inside the Vatican, there were different camps, primarily within the Board of Directors of the Pontifical Academy of Sciences and the leadership of the Dicasteries involved in health and the defense of human life. We were informed, in no uncertain terms, that unless equal numbers, pro and against "brain death" participate, there would be no conference. We were left no choice but to accept. However, one of the invited physicians in favor of "brain death" did not attend, thus, the pro-life group outnumbered the other one.

The requested conference, entitled "The Signs of Death" was convened at the Pontifical Academy of Sciences (PAS) on February 3-4, 2005. The Proceedings of this Conference were prepared for printing by the Pontifical Academy of Sciences, however as the Proceedings were readied for the printer, the Vatican declined at the 11th hour to publish the Proceedings. Much to our surprise, the PAS then organized the following year, an additional conference, using the same title, "The Signs of Death," with the participation of mostly those who support the "brain death" fallacy and the harvesting of vital organs. One neurologist, Professor D. Alan Shewmon, whose paper was read in his absence, and one Philosopher, Professor Robert Spaemann were the only invited participants who oppose the postulation that a "brain dead" person is truly dead. Much to our surprise, their proceedings were published immediately.

The participants of the February 3-4, 2005 conference, requested by His Holiness John Paul II, decided to compile their papers opposing "brain death" as true death. Under the auspices of the National Council for Research of Italy these proceedings were published in "Finis Vitae".

Prior to this February 3-4, 2005 conference, little if any opposition to "brain death" was presented, heard, or acknowledged inside the Vatican as opposition to the Harvard Criteria or any other brain-related criteria for death. His Holiness, Pope John Paul II's message to the participants was very clear: "each human being, in fact, is alive precisely in so far as he or she is '*corpore et anima unus*', (body and soul united)[v] and he or she remains so for as long as this substantial unity-in-totality subsists".

The major consideration is **Life**, which is a gift from God. The life of a person is the substantial fact of the unity of the soul and body. True death is the separation of this unity of soul from the body. After true death what is left on earth is a corpse, the remains. The body is empty. After true death the heart and unpaired vital organs are not suitable for transplantation. Therefore, how does one get a heart suitable for transplantation?

Dr. Christiaan Barnard became famous for doing the first recorded heart transplant in 1967. Dr. Barnard knew he had to get the heart for transplantation before the heart was damaged. He inserted catheters into the living donor, opened the chest, and then waited for the heart to stop. Using the already inserted catheter, he hooked the donor to a heart-lung oxygenator. This was to ensure that he was transplanting a healthy heart. Three days after the heart transplantation in South Africa, in the United States a beating heart was taken from a living baby with anencephaly. The heart was transplanted to an 18 day old infant who died within hours. Since the baby who received the heart did not live long, there was not much fanfare. However in the process two infants had their life shortened. Since the heart is not suitable for transplantation after true death, then or now, "brain death" was invented, concocted and conjured to get beating hearts for transplantation.

In 1968 the conclusions of an *ad hoc* Committee of the Harvard Medical School published in the Journal of the American Medical Association in an article entitled, "A Definition of Irreversible Coma."[vi] The publication neither contained nor had references to basic science studies or patient data. It is a fact, beginning with this first article in the American medical literature, that "brain death" was not true death; however the desire to get organs suitable for transplantation overcame science, honesty, logic and morality. This practice has since become a multi-billion dollar industry, similar to abortion.

A declaration of "brain death" includes an "apnea test," which in itself can only weaken the patient's condition and might even cause true death. This requires that the ventilator be taken away to observe if the patient can breathe on his own. The ventilator is removed for up to 10 minutes. This is in contrast to the living person taking a breath every three to five seconds to keep the carbon dioxide level in the blood between 35 and 45 mmHG. During the apnea test the carbon dioxide is increased to 60 or higher. This causes the brain to swell, which increases the pressure within the skull, which can only make the patient's condition to get worse.

The apnea test is contrary to good medical practice for the following reasons:

1. It is extremely abnormal to place a brain injured patient into further stress, which can cause additional damage to the brain. (It would be comparable to a foolish order for a heart attack victim to be subjected to run on a treadmill);
2. It can cause a drop in blood pressure, heart irregularity and even true death;
3. This abnormal condition imposed by a doctor is overlooked because of the desire to harvest the donor's organs, and;
4. The relatives of the unresponsive unconscious patient are never informed about the cruelty of placing their relative in a state of asphyxia that will make it impossible to recover to a normal daily life.

To regard a "brain dead" patient as a cadaver while his heart is still beating and his breathing is assisted by a ventilator is deceitful. One of the participants in the Pontifical Academy of Sciences (PAS) February 3-4, 2005 conference who is involved in the organ transplant industry openly admitted during a break that the donors are alive and they are being killed to extend the life of another. His reasoning being that the "quality of life" of the donor makes the person not worth saving. Such acknowledgement was not objected to by any pro-"brain death" participant in the 2005 PAS conference.

Additional proof of life in a "brain dead" donor is the fact that healing of wounds and surgical incisions occurs in "brain dead" patients, whereas, no healing can take place in a corpse after true death when the heart is no longer beating and the person is no longer breathing. (See Appendix A.)

"Rest" and unresponsiveness are part of living. When a person is asleep or under anesthetic, the person is resting and unresponsive but vitality is not lost. When the criteria is absence of functioning, function or activity, the observation is simply about rest or lack of responsiveness (perhaps a deficiency of the stimulus or the method of observation), not about destruction of the brain or part of the brain, much less a determination of true death. To regard the irreversibility of cessation of brain function (at best, a deduction from a set of symptoms) as

synonymous or interchangeable with destruction of the entire brain (one but not the only possible cause of these symptoms) is to commit a compound fallacy: identifying the symptoms with their cause and assuming a single cause when several are possible. (See Appendix B.)

The issue of "brain death" is of extreme importance for everyone who respects the life of a person created in the image and likeness of God. We ought not to declare death unless there is no doubt but that the soul has separated from the body. When there is doubt, we must not take action, such as excision of a beating heart, which would shorten life and hasten death if the patient is alive. A declaration of "brain death" is the signal given to transplant surgeons to cut out the beating heart, at which moment the true death of the human person occurs. It is a medical fact that excision of an unpaired vital organ imposes true death on the donor. Dr.KG Karakatsanis (*Department of Nuclear Medicine, Medical School, Aristotle University of Thessa!oniki, Thessa!oniki, Greece)* presented four arguments to support the view that patients who meet the current operational criteria of "brain death" do not necessarily have the irreversible loss of all brain (or brainstem) functions.[vii] Patients declared "brain dead" do not necessarily have irreversible loss of all brain (or brainstem) functions. First, many clinically 'brain-dead' patients maintain residual vegetative functions that are mediated or coordinated by the brain or the brainstem. Second, it is impossible to test for any cerebral function by clinical bedside exam, because the tracts of passage to and from the cerebrum through the brainstem are destroyed or nonfunctional. Furthermore, since there are limitations of clinical assessment of internal awareness in patients who otherwise lack the motor function to show their awareness, the diagnosis of 'brain death' is based on an unproved hypothesis. Third, many patients maintain several stereotyped movements (the so-called complex spinal cord responses and automatisms) which may originate in the brainstem. Fourth, not one of the current confirmatory tests has the necessary positive predictive value for the reliable pronouncement of human death. It was concluded that the assumption that all functions of the entire brain (or those of the brainstem) in "brain-dead" patients have ceased, is invalidated. Reconsideration of the current concept of "brain death" is perhaps inevitable. *Spinal Cord* (2008) 46, 396-401.

“Brain death" never was, and never will be true death. This has been known by neurologists and organ transplanters since the beginning of the multi-billion industry. So if a declaration of "brain death" is not true death, but organs are taken legally in accord with “accepted medical standards,” why not continue to make “acceptable” less stringent criteria? In the 10 years after the ad hoc Committee conjured up the Harvard Criteria, 30 more sets were reported by 1978. Every set became less stringent. Less strict sets were reported until eventually there is a criterion that does not fulfill any of the "brain death" criteria? This is known as donation by cardiac death (DCD). Organs are obtained for transplantation by first getting a Do Not Resuscitate Order (DNR) order, then taking the patient off life support and wait until the patient is without a pulse (NOT WITHOUT A HEART BEAT!). In the past the waiting time was 10 minutes, then shortened to 5 minutes, then 4, then 2 and now in the NEJM (8-14-08) the waiting time is only 75 seconds until the baby's beating heart was cut out. How shameful can it get! Shame on the medical field for knowing and not protecting these patients! Shame on the transplantation organizations for valuing money over an innocent injured person’s life! Shame on the US government, other governments, and clergy for allowing and even encouraging extracting vital organs for transplantation and research! When will doctors informed of the truth stand for life instead of being political creeps?

The transplant world no longer waits for “brain death.” Now the goal is to get a DNR. Then they wait until the pulse stops for as short a time as 75 seconds. Organs obtained deceptively, yet legally, are called donation by brain death (DBD) and donation by cardiac death (DCD). It is the excision of vital organs that finalizes the death of the donor.

Now more than ever, there is great push to kill for organs. It was reported in the news that Zack Dunlap from Oklahoma was declared dead, and a transplant team was ready to take his organs until that young man moved. Instead of a nurse-relative calling the movement a reflex (as I have been told is commonly done), the transplant team was sent away. http://www.msnbc.msn.com/id/23768436/. This young man did NOT have a destroyed brain. Nevertheless, Zack would have been truly dead had they excised his heart for transplantation. He could hear the doctors discuss his “brain death,” but he could not move at that time to tell them he was alive.

Other recent reports include a man from France who began breathing on his own as doctors prepared to harvest his organs (http://www.msnbc.msn.com/id/25081786).The Living God has given us life. We live in the hope of living long enough to receive the reward of heaven. Only God knows when our life on earth will end. No one—self or others—has the right to usurp God's power over life and death. Rather, we should adopt God's approach to life and live it to the fullest. It is up to everyone, but especially physicians, nurses, other medical personnel and clergy to protect and preserve life, uphold its sanctity and enhance its quality. The ultimate and fundamental reason for the practice of medicine is to keep the patient alive.

"Today there is an inescapable duty to make ourselves the neighbor of every man, no matter who he is, and if we meet him, to come to his aid in a positive way. The varieties of crime are numerous. All
against life itself, including murder, genocide, abortion, euthanasia, and willful suicide all these and the like are criminal"[viii]. Evil may not be
done that good may come of it [ix,x,xi]including ". . . whatever violates the integrity of the human person, such as mutilation, physical and mental torture and attempts to coerce the will."[xii] This includes unpaired vital organ excision, which already has been pointed out: "[V]ital organs which occur singly in the body can be removed only after death, that is, from the body of someone who is certainly dead. This requirement is self-evident, since to act otherwise would mean intentionally to cause the death of the donor in disposing of his organs."[xiii]

At a meeting in Rome on November 7, 2008 Pope Benedict XVI stated, "The body can never be considered a mere object (cf. *Deus Caritas Est*, n. 5);

"The body of each person, together with the spirit that has been given to each one singly constitutes an inseparable unity in which the image of God himself is imprinted.

"It is necessary to put respect for the dignity of the person and the protection of his/her personal identity in the first place.

"Someone can give [an organ] only if he/she is not placing his/her own health and identity in serious danger, and only for a morally valid and proportional reason.

"Transplant abuses and their trafficking, which often involve innocent people like babies, must find the scientific and medical community ready to unite in rejecting such unacceptable practices. Therefore they are to be decisively condemned as abominable.
"Individual vital organs cannot be extracted except *ex cadavere,*
which, moreover, possesses its own dignity that must be respected.
"[T]he principal criteria of respect for the life of the donator must always prevail so that the extraction of organs be performed only in the case of his/her true death (cf. *Compendium of the Catechism of the Catholic Church*, n. 476)."
The world has always relied on Divine Inspiration that God has always provided from His leaders. Guidance, protection and defense of the sanctity of life from conception until its natural end have always been a command from Our Creator. We must rescue the noble profession of medicine from the anti-life scientists and physicians who have corrupted and degraded our profession. We must stand for God; we must stop the rampant killing of donors of unpaired vital organs.

John Paul II. To the participants at the first International Congress on the Transplant of Organs, June 20, 1991, in *Insegnamenti* XIV/1 and *L'Osservatore Romano,* N. 25-24, June 1991.
[1] John Paul II. Pontifical Academy of Science. Declaration on the Artificial Prolongation of Life and Determining the Precise Moment of Death, 14 December, 1989, n. 5, *L'Osservatore Romano, N 2, Jan 8, 1990, 8,11*.
[1] John Paul II. Pontifical Academy of Science. Declaration on the Artificial Prolongation of Life and Determining the Precise Moment of Death, 14 December 1989, n. 4, *L'Osservatore Romano, N 2, Jan 8, 1990, 8,11*.
[1] John Paul II. Encyclical *Evangelium Vitae* n. 15.
[1] *Gaudium et Spes n. 14*
[1] Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death. Special Communication. *JAMA* 1968; 205(6):85-88.
[1] Karakatsanis KG. 'Brain death': should it be reconsidered? *Spinal Cord* (2008) 46, 196-401; doi; 10, 1038/sj.sc. 3102107; published on line 14 august 2007.
[1] *Gaudium et Spes*, n. 27. [1] *Veritatis Splendor, n.*79. [1] *Rom.* 3:8.
[1] *Gaudium et Spes, n 8.0.*
[1] *Gaudium et Spes, n 27.*
[1] John Paul II, Address to International Congress on Organ Transplantation, 29 Aug, 2000.

Appendix A

The Gift of Healing:

Please consider the gift of healing that comes only from God and what is included in the gift of life from God, our Creator. Healing occurs only in the living. As soon as there is exogenous or endogenous injury to a tissue, a complex healing reaction, called inflammation, occurs in the blood supplied connective tissue. This healing begins immediately at the site of the injury, but circulation is needed to bring necessary defense and healing components from distant tissues and organs to the site of injury. Blood cells known as neutrophils, eosinophils, lymphocytes, basophils and platelets are required. Along with these blood cells and platelets, circulation brings hormones, produced as part of the endocrine system to the site of injury. The breakdown products of the injury are then picked up and carried by the circulation to the liver, spleen and kidneys for detoxification and excretion. Inflammation is followed by regeneration.

Healing occurs only in the living with an intact and functioning circulatory system. No healing can occur after true death.

Indeed, healing is apparent in patients after the declaration of "brain death." For example, if a cut were made through the skin of a "brain dead" patient prior to excision of vital organs, bleeding from the wound would occur and healing would begin immediately. On the other hand, if he were truly dead, fluid could ooze out, but active bleeding would not occur. The healing processes would never occur because there would be no circulation to bring the healing white blood cells and hormones to the site of injury and no way to carry away the wastes for detoxification and excretion. There would be no living cells to unite the tissues back together. Healing does occur in those declared "brain dead," but never after true death.

Appendix B

In Opposition to Acceptance of "Brain Death" as True Death

The following has been extracted from Byrne, a neonatologist, O'Reilly, a neurologist and Quay, a theologian and Jesuit priest as published in a peer reviewed medical journal, distributed throughout the world, but never refuted in any significant fashion. Minor editing has been done by PAB for this current use.[1]

All general criteria used as standard to declare death prior to the desire to do unpaired vital organ transplantation developed from the intention to make sure that a person who is still alive will not be treated as if dead. In the past, a mistaken determination of death usually had no other result for a patient than his being allowed to die without further treatment. But new criteria are intended not only to decide as soon as possible when someone is "brain dead" but, among other options, to clear the way for the excision of his vital organs—action which, if a mistake has been made, is certain to kill the still-living patient. Since any criteria nowadays must subserve organ transplantation as well as other purposes, any new general criterion of death must be at least as certain as the older ones, since a mistake here would be lethal. Yet "brain death" criteria are far less certain than the older ones; they are not merely uncertain but certainly wrong in principle.

Nothing describable as 'brain function" is simply equivalent to human life, though, once the brain is formed, human life usually, but not always, requires some kind of perduring function of the brain. Cessation of function, whether irreversible or not, has no necessary connection with either destruction of the brain or death of the person and, therefore, cannot serve as a general criterion of death.

There is an all-pervasive philosophical sleight-of-hand that forms the hidden and often unconscious root of most arguments in favor of accepting that cessation of brain functioning is identical and equivalent to death. This can be summed up in the following line of reasoning.

The brain (or some selected portion of it) is that organ whose specific action it is to make a human person be alive. The brain cannot, therefore, by definition cease this function without making the person cease to live. Hence, cessation of total brain function (not "brain functions," some few of which, apart from this primary one, may continue for some time after death) is, by definition, identical with death of the person. This line of reasoning is implicit throughout much of the literature. Were this argument valid, then any cessation of total brain function would be death, by definition. The recoveries of all those who have shown for many hours, even days, no discernible trace of any brain function as a result of various depressant poisons or of hypothermia would have been resurrections from the dead. And if it be objected that such people not really suffer cessation of total brain function but only seemed to, then we are being offered a criterion that is empirically unable to do the *job* it was introduced to accomplish.

Philosophically, the argument implies, all unnoticed by many of its proponents, a strict materialism. It reduces the life of the human person to a putative organic function of the material brain. "Brain function" is so defined as to take the place of the immaterial principle or "soul" of man. Of course, such a materialism is a widely held philosophical option. But it stands in flat contradiction to the religious beliefs of Christians, Jews, Moslems, Hindus, and many others. Thus, no arguments based on such reasoning can be allowed if religious acceptability is claimed.

But, whatever be the merits of the argument philosophically or theologically, its medical presuppositions are untenable. The brain consists not of a single part but of several closely interrelated ones (cortex. cerebellum, midbrain, medulla, etc.). Though composed of superficially similar tissues and closely linked together both anatomca11y and physiologically, yet these parts can continue to live and act independently of one another, even when one or more of them has been destroyed. As one might then expect, the brain as a whole has no physiologically identifiable, single function that could rightly be called the "life-giving function" or the function of the brain as "organ of the whole." Rather, there exists a large multiplicity of different functions that are characteristic of the different parts. Although the characteristic functions of the brain-parts normally are closely coordinated, each part

can function without the others. Further, none of these parts is in complete control of the others. Thus, the cortex usually controls voluntary motor activity, but reflexly yields control to the midbrain if, for example, one trips while running.

In consequence, each set of secondary medical criteria that have been proposed for ascertaining “brain-death” looks or tests for the absence of the characteristic functioning proper to each of the brain parts singly. If all tests for these functions in the individual brain-parts are negative, the neurologist using these criteria is considered justified in asserting the brain to be dead, at least by that standard. Multiple criteria are required because of the multiplicity of parts and of their functions. No single criterion is ever offered as uniquely testing for this putative function of the entire brain.

The brain is, then, an organ whose varied functions serve to integrate physiologically (eg, by biophysical, biochemical, or other neuronal mechanisms) the different parts of the body. Such physiological operations of integration are, in fact, the ordinary conditions for the continuance of the organismic unity of the body. But if "total brain function" can legitimately mean no more than the sum-total of the characteristic functions of all parts of the brain, then the brain's ceasing to function does not imply, a priori, its destruction but only its loss of physiological activity. Admittedly, in the past this is a loss that usually tends, quickly if not instantaneously, to the destruction of the brain and to the disintegration of the body that we call “death.” The advent of the improved life support results in “brain dead patients continuing to live for months and years, so long as these patients have not been subjected to the apnea test and there has been a reason to continue life support, e.g., pregnancy and love of a mother for her son.

If there is an irreversible loss of all the characteristic functions of the brain, must we say the brain has died, i.e., has been wholly destroyed? “Destroy” is used in its primary sense: “to break down or disintegrate the basic structure of,” “to disrupt or obliterate the constitutive and ordered unity of.” Nowhere in consideration of brain related criteria for death should “destruction” necessarily imply abruptness or physical violence. For the brain, "destruction" implies such damage to the neurons that they

disintegrate physically both individually and collectively. The converse, of course, is obvious: the total destruction of the entire brain does imply irreversible cessation of every kind of brain function, functioning and activity. Whether total destruction of the brain is simply equivalent to the death of the person (no generally acceptable criteria for this exists) is a different question.

There are evidently many varieties of reversible cessation of brain-functioning known. Most of these are nondestructive. But no medical principle requires that a nondestructive cessation of function must always be reversible. There is no evident contradiction in supposing the existence of permanent synaptic barriers, permanent analogs of botulinus toxin or morphine, or yet other mechanisms that would block all brain functioning while leaving the brain's neuronal structure intact and ready for action (at least until such time as the effects of this nonfunctioning on the rest of the body might react back on the brain in a destructive manner). Therefore, there is no reason to think that cessation of functioning or activity, whether reversible or irreversible, necessarily implies total or even partial destruction of the brain; still less, death of the person.

The same distinction, applied to other organs and functions has been of major importance for the advance of medicine. For centuries, irreversible cessation of breathing was taken as a sure token of death or its immediate presage. Once it was realized that the bronchial tree and lungs need not have been destroyed by that irreversible cessation, the advent of mechanical ventilators was assured. Not many years ago, cessation of heartbeat was taken as equivalent to death. Medically, it was irreversible. Yet physicians came to see that, so long as the heart itself was not destroyed by the arrest, a potentiality for continued function remained and the various means of cardiac resuscitation were developed. Moved by such considerations, successful brain resuscitation has occurred in cases where both brain-related criteria and the older, generally accepted ones would have justified a declaration of death. Once again, it is the presence of the soul and the existence of the organ that is primarily significant, not its functioning.

Thus, acceptance of a loss of brain function or activity into a general criterion of true death is vitiated by a fundamental category mistake: they take *that which functions* to be simply identical with its *functioning.* Yet, if something irreversibly ceases to function, its existence is not necessarily extinguished thereby; it merely becomes permanently idle. Nonfunction, no matter what qualifiers are used with it, is not the same thing as destruction.

In any case in which all functioning of the brain has irreversibly ceased, destruction of the brain and death will follow fairly quickly unless vigorous therapeutic action is taken. But if proper supportive action is taken, such an irreversible lack of brain function might well last for a long time before the patient would begin to suffer destruction of brain tissue and die.

In such circumstances one would certainly not be free to treat a patient as dead. So long as we are dealing solely with cessation of function, functioning or activity, we are dealing with a living patient. If, further, it happens that he is said to be dying, by this very fact he is not yet dead. Whatever room there may be for discussion, pro and con, concerning obligations to maintain the supportive action that prevents the situation from deteriorating, at least as long as destruction of the brain has not occurred, the patient is alive. As far as it is now known e.g., stem cell research, there would even remain some possibility that a successful therapy might be found.

In addition to confounding what functions with its functioning, brain related criteria introduce further confusion through "irreversibility" and its cognates. Irreversibility as such is not an empirical concept and cannot be empirically determined. Both destruction of the brain and the cessation of its functioning and certain activities are, in principle, directly observable; such observations can serve as evidence. Irreversibility, however, of any kind, is a property about which we can learn only by inference from prior experience. It is not an observable condition. Hence, it cannot serve as evidence, nor can it rightly be made part of an empirical criterion of death.

For example, if someone's head has been completely crushed by a truck or vaporized by a nuclear blast, or if his brain has been dissolved by a massive injection of sulfuric acid, then a cessation of function has occurred that we rightly see as absolutely irreversible. But it is the manifest destruction of his brain that convinces us of this total irreversibility, not vice versa. But if there is no proof of complete destruction, then any declaration that a cessation of functioning, function or activity is absolutely irreversible is a presumption, even if well grounded, which is contingent on the current state of medical knowledge and on the availability of adequate life-support systems in the concrete circumstances. Even if the presumption is correct, it establishes, as seen above, no necessary link with destruction of the brain. If it is incorrect, the patient may possibly be cured. Thus, whether right or wrong, a presumption as to the irreversibility of a lack of brain function or activity is insufficient ground for removing a patient's vital organs or for immediate autopsy, cremation, or burial.

Overdoses of morphine or of barbiturates, interactions of drugs, hypothermia, cardiovascular shock, and a number of metabolic and other disorders have all, in times past, brought about cessation of all brain function that was, in fact, irreversible. Yet means have gradually been found to reverse, at least occasionally, these previously irreversible types of loss of function. At least the first time each of these conditions was successfully reversed, some patient survived whose vital organs could have been taken on the basis of the brain-related criteria, had no reversal been attempted. Further, if irreversible cessation of total brain function, functioning or activity were the same thing as destruction of the brain, there would be no purpose to any research designed to discover how to turn any current, medically irreversible cessation of function into a reversible one. Yet such research continues to be remarkably fruitful.

In brief, to regard the irreversibility of cessation of brain function (at best, a deduction from a set of symptoms) as synonymous or interchangeable with destruction of the entire brain (one but not the only possible cause of these symptoms) is to commit a compound fallacy: identifying the symptoms with their cause and assuming a single cause when several are possible.

The Heart of the Matter

JOHN ANDREW ARMOUR

I. *The Issue at Hand*

"The heart is the root of life."
(Chi' Po)[1]

What is the relationship between the heart and the brain and, for that matter, the rest of the body? People's ability to maintain their emotional and physical well-being reflects, in large part, their ability to cope with daily stress. Exposure to stress for relatively long periods of time can result in prolonged activation of the sympathetic efferent nervous system that, in turn, may lead to various pathologies[2] such as heart disease.[3] A feeling of lack of control over one's external environment in an ever demanding world may

[1] Chi' Po's response to the Yellow Emperor's enquiry about precious viscera in *The Yellow Emperor's Classic on Internal Medicine* (c 2700-2600 B.C.), edited by I. Veith, Berkeley, Universi ty of California Press, 1970, p. 139.

[2] *Breakdown in Human Adaptation to 'Stress': Towards a Multidisciplinary Approach*, edited by J. Cullen, J. Siegrist, H.M. Wegmann, Boston, Martinus Nijhoff Publishers for the Commission of the European Communities, 2 vol., 1984.

[3] J. Bassett, *Psychic stress and the coronary artery in ischemic heart disease*, in *The Coronary Artery*, edited by S. Kalsner, New York, Oxford University Press, 1982, p. 474-500; J. Cullen, J. Siegrist, *Psychological and social parameters for studies of breakdown in human adaptation*, in *Break down in Human Adaptation to 'Stress': Towards a Multidisciplinary Approach*, vol. I, part 1, p. 1- 271; C. Gaganon, S. Ramachandruni, E.E. Bragdon, D.S. Sheps, *Psychological Aspects of Heart Dis ease*, in *Basic and Clinical Neurocardiology*, edited by J.A. Armour, J. L. Ardell, New York, Oxford University Press, 2004, p. 393-418; J.E. Muller, P.G. Kaufmann, R.V. Luepker, et al., *Mechanisms precipitating acute cardiac events: review and recommendations of an NHLBI workshop*, in "Circu- lation," 96, 9, 1997, p. 3233-3239; A. Myers, H.A. Dewar, *Circumstances attending 100 sudden deaths from coronary artery disease with coroner's necropsies*, in "British Heart Journal," 37, 1975,
p. 1133-1143.

eventually lead to an imbalance of *self* within one's environment. The feeling of lack of empowerment that this may engender has become an issue for all segments of our global society.

In agreement with that concept, a number of years ago a United Nations World Bank study identified heart disease as the leading cause of death throughout the world - even in financially disadvantaged regions.[4] Dr. Everard Holm, reporting in 1798 on the medical condition of his brother- in-law, Dr. John Hunter, wrote that Hunter developed pain associated with his heart when his mind was 'irritated'. Becoming upset during a hospital board meeting, he fell into a 'state of restraint' from which he failed to re- cover as he died suddenly.[5] The autopsy that Dr. Holm subsequently per- formed on Dr. Hunter's body indicated that his coronary arteries were 'bony tubes,' hardened by local calcification. Since that time, physicians have focused on coronary artery narrowing or (stenosis) associated with heart disease to the exclusion of cardiac control - the plumbing aspect of heart disease.

For over a hundred years the heart has been thought of in terms of its complex muscular anatomy and local coronary arterial blood supply. As a consequence, it has been promulgated that while this autonomously func- tioning muscle pump may at times be under the influence of circulating hor- mones and autonomic efferent neurons, that aspect plays a minor role in the etiology of cardiac disease. Furthermore, it has been taught that such cardiac regulation relies on a simplistic reciprocal motor control system. Such con- trol was conceived of comprising inhibitory (parasympathetic efferent) and augmentor (sympathetic efferent) motor neurons that function, along with the circulating adrenal gland hormone adrenaline,[6] under the control of cen- tral neuronal command[7] to regulate the heart. The difference between con-

[4] *Breakdown in Human Adaptation to 'Stress': Towards a Multidisciplinary Approach*.

[5] F. Willius, T. Keys, *Classics in Cardiology*, New York, Dover Publications, 1961.

[6] N.-A. Hillarp, *Peripheral autonomic mechanisms*, in *Handbook of Physiology*. Section I: *Neu- rophysiology*, edited by J. Field, Washington, American Physiological Society, 1960, p. 979-1006;
A. Kuntz , *The Autonomic Nervous System*, Philadelphia, Lea & Febiger, 1934.

[7] C.D. Lewis, G.L. Gebber, P.D.Larsen, et al., *Long-term correlations in the spike trains of medullary sympathetic neurons*, in "Journal of Neurophysiology," 85, 2001, p. 1614-1622; H. Se- lye, *The Physiology and Pathology of Exposure to Stress*, Montreal, Canada, Aecta, 1955.

sidering cardiac control to reside solely with central command as opposed to the recently uncovered emergent properties displayed by the heart's neuronal hierarchy is the issue at hand.

II. *Basic Cardiac Anatomy and Function*

"Marvelous instrument, invented by the Supreme Maker."
(Leonardo Da Vinci)[8]

The law of the heart. In the late 19th century, Otto Frank depicted the work produced by a heart in terms of its returning venous blood. He characterized the function of frog or turtle hearts in terms of returning venous blood. Alterations in venous return would alter the distention that a cardiac chamber undergoes and, as a consequence, the force generated by the muscle of that chamber regulated.[9] More venous return means more chamber stretch and thus an increase in its capacity to generate force to subsequently expel a greater volume of blood from that chamber. This *law of the heart* depicting cardiac output in terms of venous return was soon applied to the contractile properties of mammalian right[10] and left[11] ventricles. The more blood that returned to a mammalian ventricle the more its walls stretched to thereby induce greater force generated by that chamber's muscles. Hence, the more venous blood entering the heart during each cardiac cycle the more blood expelled into the pulmonary artery or aorta. In such a scenario, control over cardiac output resides totally within the muscular makeup of the organ.

However, this *law* does not take into account the fact that a constraining fi- brous sac - the tightly fitting pericardium that keeps it in place, encases the heart. Such physical restraint normal restricts dilation (i.e., stretching) of ven- tricular walls on a short-term basis. In other words, during exercise when venous return increases each ventricular chamber cannot undergo much change

[8] A note written by Leonardo Da Vinci to accompany one of his heart drawings, in *The Note books of Leonardo DaVinci*, edited by R.N.Linscott, New York, Random House, 1957.
[9] O. Frank, *On the Dynamics of Cardiac Muscle,* in "American Heart Journal," 58, 1959; p. 282-317.
[10] C.J. Wiggers, *Some factors controlling the shape of the pressure curve in the right ventricle*, in "American Journal of Physiology," 33, 1914, p. 382-296.
[11] S.W. Patterson, H. Piper, E.H. Starling, *The regulation of the heart beat*, in "Journal of Phys iology," 48, 1914, p. 465-513.

in diastolic (resting) dimension due to the physical constraints of the tightly fit- ting pericardial sac. In fact, increased cardiac output elicited during enhanced sympathetic efferent neuronal tone occurs concomitant with reduction in left ventricular end-diastolic volume.[12] As the later obviates any possibility of ven- tricular wall stretching during diastole over a few beats, increased force gener- ation appears to be primarily neurohumorally driven. Thus, the thesis that en- hanced cardiac output during increased demand depends in normal states pri- marily on ventricular wall stretch does not appear to be able to account for the exponential increases in cardiac output that each ventricle is capable of gener- ating during maximal demand. With respect to how the heart matches whole body flow demands in healthy states, the unaccounted variable that may account for such emergent properties appears to reside in neurohumoral mechanisms that can be rapidly brought into play during stress.

III. *Guiding Principles of Neurocardiology*

"For out of the abundance of the heart the mouth speaketh."
(Matthew, 12:34)

The nervous system devoted to regulating our *internal* environment, the autonomic nervous system, has long been conceived of as lacking conscious control. This internal nervous system has been assumed to maintain our internal milieu independent of reason, beneath consciousness, that is in an *autonomous* fashion. The fact that this nervous system rarely impinges on our consciousness should not be interpreted as indicating that it is 'primitive', functioning in a totally independent manner.

IV. *The Autonomic nervous System*

Neuronal control of our internal organs and protective outer coat (skin) is based upon sensory and effector (motor) neurons that interact in concert with circulating hormones to maintain a stable *milieu interieur*. Its motor

[12] I.G. Burwash, D.E. Morgan, C.J. Koilpillai, et al., *Sympathetic stimulation alters left ven- tricular relaxation and chamber size*, in "American Journal of Physiology - Regulatory, Integrative and Comparative Physiology," 264, 1, 1993, p. R1-R7.

component is made up of two major branches, the sympathetic efferent ner- vous system and the parasympathetic efferent nervous system. The sympa- thetic nervous system is generally considered to predominate during 'fight- or-flight'.[13] When major external stressors arise (*e.g.* being chased by a tiger), activation of sympathetic efferent neurons enhances cardiac output to in- creasing blood flow to limb muscles, thereby allowing us to run from such an aversive event. In contrast, while relaxing after supper and digesting a meal, the parasympathetic nervous system predominates (gastric juices flow and limb motion is at a minimum) so that blood flow is directed to digestive or- gans and away from our skeletal muscles. This simplistic 'accelerator and brake' thesis,[14] although applicable in some situations, in fact does not hold true for most events that confronts one over a lifetime.

The autonomic nervous system is, in fact, a stochastic control system that displays not necessarily directly predictable, that is emergent, properties. Its central component is made up of anatomically distinct populations of cere- bral,[15] brain stem[16] and spinal cord[17] neurons. Central and peripheral neurons are in constant communication in the regulation of internal (visceral) organs. Clusters of neurons that regulate each major organ (i.e., the gastrointestinal tract, heart, lungs, kidneys or urinary bladder) generally lie adjacent to the organ they sub-serve. Furthermore, functional interconnections exist between these clusters of neurons such that they form distributive networks for information exchange. For instance, neurons that control the respiratory tract communicate with those controlling the heart, many lying adjacent to one another in the same intrathoracic ganglion. Presumably this facilitates proper coordination of multiple organ function such as is required between, for instance, the heart and lungs.

[13] W. Cannon, *Bodily Changes in Pain, Hunger, Fear and Rage: An Account of Recent Re searches into the Function of Emotional Excitement*, New York, D. Appleton & Company, 1929, 2nd ed.; H. Selye, *The Physiology and Pathology of Exposure to Stress*.

[14] M. Levy, M. Warner, *Parasympathetic Effects on Cardiac Function*, in *Neurocardiology*, edit ed by J. Armour and J.L. Ardell, New York, Oxford University Press, 1994, p. 53-76.

[15] D.F. Chechetto, *Forebrain Control of Healthy and Diseased Hearts*, in *Basic and Clinical Neu- rocardiology*, edited by J.A. Armour and J.L. Ardell, New York, Oxford University Press, 2004, p. 220-251.

[16] M.C. Andresen, D.L. Kunze, D.Mendelowitz, *Central Nervous System Regulation of the Heart*, in *Basic and Clinical Neurocardiology*, edited by J.A. Armour and J.L. Ardell, p. 187-219.

[17] R.D. Foreman, M.J.L. DeJongste, B.Linderoth, *Integrative control of cardiac function by cer vical and thoracic spinal neurons*, in *Basic and Clinical Neurocardiology*, edited by J.A. Armour and J.L. Ardell, p. 153-186.

Autonomic neurons regulate the internal environment in concert with central neurons that sense the external environment. When all is well, the various components of the autonomic nervous system associated with each major internal organ do not transfer much information to central neurons; hence our lack of awareness of our normally functioning inner world. What else would you expect of an efficient nervous system organized to maintain your internal environment? It is during the breakdown of internal organ function that enhanced sensory inputs to the central nervous system makes us aware of alterations in our internal environment. Presumably that occurs because of the fact that sensory information arising from a diseased organ increases to such a degree that it impinges on our consciousness. That, in turn, may result in altered motor control such that pathology may arise in select organs (i.e., skin disease, gastric ulcers, ulcerative colitis or cardiac dysfunction).

V . *Historical Perspective of the Autonomic nervous System*

"The brain is not responsible for any sensations. The correct view is that the seat and source of sensations
is in the region of the heart."
(Aristotle)

Although the quotation presented immediately above is now recognized to be simplistic, the concept of *sympathy* between bodily organs has been under- stood for a long time. The first evidence we have for this view has been attrib- uted to Galen of Pergamum (130-200 A.D.). He proposed that sympathy be- tween various bodily functions was made possible by an internal, *autonomously functioning* nervous system. Enlarging on concepts developed by ancient philosopher scientists, Galen proposed that body sympathies are coordinated via the rows of interconnecting ganglia strung along either side of the thoracic and abdominal spine. In 1543 Andreas Vesalius published his anatomical mas- terpiece entitled *De Humani Corporis Fabrica* in which he presented a surpris- ingly accurate anatomical description of major cardiac nerves.[18] Building on

[18]J.B.deC. Saunders, C.D. O'Malley, *The illustrations for the works of Andreas Vesalius of Brussels*, Cleveland, OH, World Pub. Co., 1950, Sixth Book, plate 65.

the earlier work of Bichat,[19] at the beginning of the last century, Gaskell[20] and Langley[21] classified at the beginning of the last century internal ganglia according to whether they lay in close proximity to the organs they inner- vate (parasympathetic ganglia) or adjacent to the spine (sympathetic gan- glia). It is now recognized that the parasympathetic component is made up of central autonomic efferent neurons whose nerves arise primarily from the mid-brain (*i.e.*, to the ciliary ganglion) and brainstem (*i.e.*, the seventh, ninth and tenth cranial nerves). With respect to the tenth cranial nerve, the vagus or wandering nerve contains the largest autonomic (parasympathet- ic efferent) neuronal outflow from the brain. This *vaga*bond nerve also pos- sesses a sizable population of afferent axons connecting medullary (central) neurons with sensory neurites (transducers of their local milieu) in various internal organs, including the heart.[22]
Subsequently, Walter B. Cannon characterized the functional state of mammals as being generally unstable, being constantly subjected to various disturbances.[23] Such disturbances in our *milieu interieur* are counteracted by neurohumoral factors that maintain the stability of the organism - what Can- non called *homeostasis*. Thus, neurohumoral mechanisms are constantly at play regulating the internal organs via cooperative factors such as chemicals that reach a target organ via the circulation or those released from local nerve endings. One of the best known of these circulating hormones is *epinephrine*, so named because it is produced by small glands on top of each kidney (*epi- nephros*). Hans Selye, enlarging upon this thesis, elaborated a concept of general bodily adaptation to external noxious stimuli via our neurohumoral axis.[24]

[19] M.F.X. Bichat, *Recherches physiologiques sur la vie et la mort*, Paris, Brosson, Gabon et Cie, 1802.
[20] W. Gaskell, *The Involuntary Nervous System*, London, Longmans, Green and Co., 1916.
[21] G. Langley, *The Autonomic Nervous System*, Cambridge, Cambridge University Press, 1921.
[22] J.A. Armour, *Anatomy and function of the intrathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore, Boca Raton, FL, CRC Press, 1991, p. 1-37; M. Levy, M. Warner, *Parasympathetic Effects on Cardiac Function*, in *Neurocardiology*, edited by J. Armour and J.L. Ardell.
[23] W. Cannon, *Bodily Changes in Pain, Hunger, Fear and Rage: An Account of Recent Re searches into the Function of Emotional Excitement*, New York, D. Appleton & Company, 1929, 2nd ed.
[24] H. Selye, *The Physiology and Pathology of Exposure to Stress*.

The identification of *little brains* in the heart,[25] gut[26] and other organs that are dedicated to self-regulation of the organs that they subserve suggest that the autonomic nervous system is made up of local networks involved in main- taining the *milieu intereur* in a manner not totally subservient to central neu- ronal command. These collections of neurons have the capacity to process sensory information arising from an organ to influence efferent neuronal in- put to that organ - local reflex control. The idea that peripheral autonomic ganglia function as *little brains* dates from the time of Joacque Benigne Winslow, a Swedish anatomist working in Paris during the 18th century. Bichat proposed that these *little brains* play a key role in maintaining normal organ function.[27] Moreover, these collections of neurons communicate with one another on an ongoing basis to coordinate internal organ function with minimal inputs from higher order neurons. Normally, they do not impinge very much on cerebral function. Hence our general lack of awareness of nor- mal internal organ function. In other words, these peripheral neuronal net- works perform the routine tasks required to maintain organ function in nor- mal states, thereby ensuring that the central nervous system is not flooded with afferent information arising from each internal organ.[28]

[25] J.L. Ardell, *Intrathoracic Neuronal Regulation of Cardiac Function*, in *Basic and Clinical Neu- rocardiology*, edited by J. Armour A. and J.L. Ardell, p. 118-152; J.A. Armour, *Anatomy and func tion of the intrathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circula tion*, edited by I.H. Zucker and J.P.Gilmore; W.C. Randall, R.D. Wurster, D.C. Randall et al., *From cardioaccelerator and inhibitory nerves to a Heart Brain: an Evolution of Concepts*, in *Nervous Con trol of the Heart*, edited by J.T. Shepherd and S.F. Vainer, Amsterdam, Harwood Academic Pub lishers, 1996, p. 173-200.

[26] H. Cooke, *Role of the 'little brain' in the gut in water and electrolyte homeostasis*, in "FASEB Journal," 3, 1989, p. 127-138.

[27] M.F.X. Bichat, *Recherches physiologiques sur la vie et la mort.*

[28] J.A. Armour, *Anatomy and function of the intrathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore.

VI. *The Cardiac Nervous System*

"The heart receives many nerve fibers and offshoots from the major thoracic nerves, all of which give off branches to each auricle as they pass along between the pulmonary artery and the aorta and are then distributed widely to the heart-substance."
(R. Lower)[29]

In the last ten years evidence has accumulated for the presence of a func- tional heart brain.[30] From a neuroscience perspective, the nervous system in- trinsic to the heart can sense alterations in the mechanical and chemical milieu of various cardiac regions. Thus, with every heartbeat changes in heart rate and regional contractility are transduced via neuronal impulses to not only central neuronal command, but also to motor neurons in the thorax, including those on the heart. In this manner, cardiovascular sensory information is returned to motor neurons innervating the substance of the heart via intermediate neurons located throughout the cardiac neuronal hierarchic -from the level of the heart to that of the cerebral cortex in the brain.

VII. *Interactions Among Intrathoracic Autonomic Neurons*

Intrathoracic ganglia have long been thought to act as simple relay stations of solely efferent inputs to internal organs such as the heart.[31] Information arising the central nervous system affecting an internal organ has been thought to involve one synapse located between central preganglionic and postgan-glionic efferent (motor) neurons in peripheral sympathetic or parasympathet-ic ganglia.[32] Presumably that is why cardiac parasympathetic and sympathetic

[29] R. Lower, *Tractatus de Corde*, London, Redmayne & Allestry, 1669: see *Chapter 1*, "Cordis Situs & Structura."
[30] J.L. Ardell, *Intrathoracic Neuronal Regulation of Cardiac Function*, in *Basic and Clinical Neu- rocardiology*, edited by J.A. Armour and J.L. Ardell; J.A. Armour, *Anatomy and function of the in- trathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by
I.H. Zucker and J.P.Gilmore; W.C. Randall, R.D. Wurster, D.C. Randall et al., *From cardioacceler- ator and inhibitory nerves to a Heart Brain: an Evolution of Concepts*, in *Nervous Control of the Heart*, edited by J.T. Shepherd and S.F. Vainer.
[31] V.I. Skok, *Physiology of Autonomic Ganglia*, Tokyo, Igaku Shoin, 1973.
[32] A. Kuntz, *The Autonomic Nervous System*.

efferent neurons were considered to act in a reciprocal manner totally under central command, such that when one population is activated the other becomes suppressed.[33] In such a scenario intrathoracic ganglia act as mono- synaptic relay stations of centrifugal (efferent) inputs to the heart.[34]

However, the cardiac nervous system is organized to provide the flexibil- ity necessary for beat-to-beat regulation of efferent outflow to the heart via short (intrinsic cardiac ganglia), medium (middle cervical and stellate gan- glia) and relatively long (spinal cord and brain) latency feedback loops. Since the peripheral cardiac nervous system contains afferent and interconnecting neurons to efferent ones, afferent information arising from the heart is processed within or adjacent to the heart to affect motor neurons that coor- dinate regional cardiac function. The term local circuit neuron[35] has been used to describe the population of neurons in the thorax that interconnect cardiac sensory and motor neurons.[36] It has been further proposed that local circuit neurons in intrathoracic ganglia involved in feed-forward regulation of regional cardiac function display short-term memory to affect subsequent cardiac beats for up to 20 seconds from an initiating event.[37] Information pro- cessing within the intrathoracic autonomic nervous system appears to de- pend, to a considerable extent, upon such local circuitry.[38] Together, neurons within the chest, including those on the heart, process information arising not only from the heart and major intrathoracic vessels but also other body re- gions transmitted indirectly to them via the spinal cord to influence cardiac motor neurons. These interactions involve short-term memory that permits feed-forward information from one cardiac cycle to influence cardiac events for the next few cardiac cycles.

[33] M. Levy, M. Warner, *Parasympathetic Effects on Cardiac Function*, in *Neurocardiology*, edit ed by J. Armour and J.L. Ardell.

[34] N.-A. Hillarp, *Peripheral autonomic mechanisms*, in *Handbook of Physiology*. Section I: *Neurophysiology*, edited by J.Field; V.I. Skok, *Physiology of Autonomic Ganglia*.

[35] J.E. Hamos, S. C. Van Horn, D. Raczkowski, et al., *Synaptic connectivity of a local circuit neurone in lateral geniculate nucleus of the cat*, in "Nature" (London), 317, 1985, p. 618-621.

[36] J.L. Ardell, *Intrathoracic Neuronal Regulation of Cardiac Function*, in *Basic and Clinical Neu- rocardiology*, edited by J.A. Armour and J.L. Ardell; J.A. Armour, *Anatomy and function of the in- trathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore.

[37] J.A. Armour, *Anatomy and function of the intrathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore.

[38] G.C. Kember, G.A. Fenton, K. Collier et al., *Stochastic resonance in a hysteretic population of cardiac neurons*, in "Physical Review. E," 61, 2000, p. 1816-1824.

That such information processing can occur within the target organ sup- ports the thesis that the heart's little brain controls its function much of the time with little input from central neurons.[39] In addition to responding rapidly to alterations in the local cardiac milieu, the heart's local neuronal circuitry displays short-term memory independent of central command.[40] Thus, Current evidence points to a sophisticated cardiac neuronal hierarchy made up of intrinsic cardiac, intra- thoracic extracardiac and central neurons dis- playing redundant control. Such an arrangement insures that if part of the peripheral autonomic nervous system becomes compromised, limited alter- ations in cardiac control ensue.[41]

VIII. *Peripheral and Central Autonomic Neuronal Interactions*

As mentioned above, sensory neurites (sensors) located in tissues throughout the body, including major extrathoracic vessels, interact via spinal cord[42] and brainstem[43] neurons to modulate cardiac motor neurons.[44] That a population of intrinsic cardiac neurons receives indirect information from sensors in the arms may explain why individuals who experience angi- na of cardiac origin may find symptomatic relief by rubbing the skin over their elbow. On the other hand, the reverse holds true in as much as increas- ing central neuronal inputs arising from dorsal root cardiac afferent neurons can be misconstrued as arising from upper limb afferent neurons such that

[39] J.L. Ardell, *Intrathoracic Neuronal Regulation of Cardiac Function,* in *Basic and Clinical Neu- rocardiology*, edited by J.A. Armour and J.L. Ardell; J.A. Armour, *Anatomy and function of the in- trathoracic neurons regulating the mammalian heart,* in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore; J.A. Armour, K. Collier, G.Kember et al., *Differential selectivity of cardiac neurons in separate intrathoracic ganglia*, in "American Journal of Physiology," 274, 1998, p. R939-R949.

[40] G.C. Kember, G.A. Fenton, K. Collier et al., *Stochastic resonance in a hysteretic population of cardiac neurons*.

[41] J.A. Armour, K. Collier, G.Kember et al., *Differential selectivity of cardiac neurons in sepa rate intrathoracic ganglia*.

[42] R.D. Foreman, M.J.L. DeJongste, B.Linderoth, *Integrative control of cardiac function by cer vical and thoracic spinal neurons,* in *Basic and Clinical Neurocardiology,* edited by J.A. Armour and J.L. Ardell.

[43] M.C. Andresen, D.L. Kunze, D.Mendelowitz, *Central Nervous System Regulation of the Heart*, in *Basic and Clinical Neurocardiology*, edited by J.A. Armour and J.L. Ardell.

[44] J.A. Armour, *Anatomy and function of the intrathoracic neurons regulating the mammalian heart,* in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore.

anginal pain is referred to the arm.[45] These data indicate there is two-way in- formation transfer between the heart and peripheral tissues via peripheral and central (spinal cord) neurons.

IX *The Autonomic Nervous System in Altered States.*

> "Three candles dispel darkness: truth, knowledge and the ways of the heart."
> (Old Celtic Proverb)

When our autonomic nervous system is overwhelmed by repeated exposure to emotional or physical stress, it can become maladaptive such that dysfunction of an organ secondary to its deranged autonomic neuronal inputs can occur. There is ample evidence indicating that stress plays an important role in the pathogenesis of gastro-duodenal ulcers, high blood pressure or skin diseases, as well as in sudden cardiac death.[46] As a matter of fact, a person's ability to perform the simplest of mental (i.e., arithmetic) or physical tasks may become impaired when the central nervous system is flooded with afferent information (perceived as pain) arising from a diseased internal organ. This occurs when passing a kidney stone or having a heart attack. Consciousness then becomes fixated on survival.

[45] C. Sylvén, *Angina pectoris. Clinical characteristics, neurophysiological and molecular mecha nisms*, in "Pain," 36, 1989, p. 145-167.
[46] D.S. Krantz, W.J. Kop, H.T. Santiago, et al., *Mental stress as a trigger of myocardial ischemia and infarction,* in "Cardiology Clinics," 14, 2, 1996, p. 271-287; J.E. Muller, P.G. Kaufmann, R.V. Luepker, et al., *Mechanisms precipitating acute cardiac events: review and recommendations of an NHLBI workshop*; A. Myers, H.A. Dewar, *Circumstances attending 100 sudden deaths from coro nary artery disease with coroner's necropsies*.

Relevance of a Nervous System Intrinsic to the Heart

"The dominant force in the whole body is that guiding principle which we term mind or intellect.
This is firmly lodged in the mid-region of the breast - the heart. Here is the place where fear and alarm pulsate. Here, then, is the seat of the intellect and the mind."
(Lucretius)[47]

The presence of a here-to-fore unrecognized *little brain on the heart* has im- plications with respect to understanding how the heart functions within your body.[48] That such a local control system exists presumably permits complex control to occur at the level of the heart, particularly during quiescent states when the heart needs relatively little input from the central nervous system.[49] On the other hand, minor changes in central neuronal command to this target organ nervous system may exert devastating effects on cardiac function.[50]

Cardiac myocytes are continuously bathed with chemicals arising from adjacent autonomic nerve terminals and those born by the blood.[51] Adult mammalian cardiac myocytes, when cultured alone in the absence of auto-nomic neurons, rapidly dedifferentiate (lose their cellular organization) such that they do not retain their contractile properties. Conversely, cardiomy-ocytes cultured in the presence of intrinsic cardiac neurons retain both their anatomical and functional integrity. These data support the relevance of tonic neurochemical inputs to cardiac muscles that heep to sustain adequate car-diae function.[52]

As mentioned above, it has long been taught that cardiac contractility de- pends primarily upon alterations in the resting (diastolic) length of individual cardiomyocytes. During diastole, the ventricles are relaxed while being

[47] Lucretius, *On the Nature of Things*, Book III.
[48] J. Kresh, J. Armour, *The heart as a self-regulatory system: Integration of hemodynamic mech anisms*, in *Technology and Health Care 9*, edited by P. Lunkenheimer, I.O.S. Press, 1997, p. 1-11.
[49] J.A. Armour, *Anatomy and function of the intrathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore.
[50] D.F. Chechetto, *Forebrain Control of Healthy and Diseased Hearts*, in *Basic and Clinical Neu- rocardiology*, edited by J.A. Armour and J.L. Ardell.
[51] A. Kuntz, *The Autonomic Nervous System.*
[52] M. Horackova, J.A. Armour, *Role of peripheral autonomic neurons in maintaining adequate cardiac function*, in "Cardiovascular Research," 30, 1995, p. 326-335.

distended by returning venous blood; in other words, cardiomyocytes are be- ing passively stretched. The greater the degree of stretch, the greater the con- tractile force cardiomyocytes are capable of generating during the subse- quent beat. This Frank-Starling hypothesis (c.f., above) has long been con- sidered to be the primary factor accounting for increases in cardiac output in as much as circulating hormones and cardiac neurons exert relatively minor effects in non-exercising states. This concept is appropriate when studying the heart outside the body, including in isolated segments. However, it may have little bearing on how the heart normally behaves beat-to-beat in its con- straining pericardial sac *in situ*.[53]

As mentioned above, in actuality the ventricles cannot expand very much *in situ* on a short-term basis because of the relatively inelastic (that is con- straining) pericardium that surrounds the mammalian heart. Thus, on a short-term basis it is unlikely that diastolic ventricular myocyte stretch con- tributes significantly to increasing cardiac output in the presence of increas- ing venous return. Rather, during stress states cardiac output increases pri- marily because of enhanced neurohumoral inputs.[54] Increased demand is also accompanied by greater relaxation of the ventricles, thereby facilitating venous return to match increasing heart rate.[55] In fact, cardiac sympathetic efferent neurons enhance cardiac work primarily by increasing heart rate while reducing left ventricular cavity size during both diastole (the relaxed state) and systole (peak of contraction). A necessary corollary of this concept is the fact that ventricular chamber relaxation rate also increases to accommodate enhance ventricular chamber filling. Taken together, these data indicate that during stress cardiac output increases at a time when left ventricular cham- ber dimensions remain the same size or even decrease.[56] This represents an emergent property of the heart represented by its control that functions par- allel to inherent properties of cardiac myocytes depicted by the Frank-Star- ling hypothesis.

[53] I.G. Burwash, D.E. Morgan, C.J. Koilpillai, et al., *Sympathetic stimulation alters left ven tricular relaxation and chamber size*.

[54] J. Bassett, *Psychic stress and the coronary artery in ischemic heart disease*, in *The Coronary Artery*, edited by S. Kalsner, New York, Oxford University Press, 1982, p. 474-500.

[55] I.G. Burwash, D.E. Morgan, C.J. Koilpillai, et al., *Sympathetic stimulation alters left ven tricular relaxation and chamber size*.

Autonomic Neuronal Control in Altered Cardiac States

"Only take heed to thyself, and keep thy soul diligently lest thou forget the things which thy eyes saw and
least they depart from thy heart all the days of thy life."
(Deuteronomy, 4:9)

The transplanted mammalian heart offers a unique opportunity to study the intrinsic cardiac nervous system, given the fact that many intrinsic cardiac neu- rons maintain their capacity to regulate the heart following cardiac transplanta- tion.[57] Following cardiac transplantation, the nervous system intrinsic to the heart is on its own so to speak. Although over time the intrinsic cardiac neurons can receive inputs from more centrally located neurons of the recipient, if im- muno-compatibility exists between the donor heart and its new host. In that case, the situation arises in which intrinsic cardiac neurons of a donor are under the control of recipient central neurons. This represents a situation in which a patient's central nervous system interact with neurons (intrinsic cardiac ones) of another individual - an interesting concept with which to challenge ethicists.
The cardiac nervous system can also be intimately involved in cardiac pathology.[58] As mentioned above, sensory information derived from a diseased heart, such as occurs during a heart attack or in the presence of heart failure, may provide unusual high sensory inputs to central neurons from the affected heart. The flooding of the central nervous system with such novel information may modify the behavior of cerebral neurons so that the individual becomes aware of cardiac status. The pain so experienced may disable individuals. Lethal cardiac arrhythmias can occur if neurons throughout the cardiac neuroaxis from the level of the insular cortex to that of the intrinsic cardiac nervous system become excessively activated in the transduction of a heart attack.[59] As a matter of fact, intrinsic cardiac neurons continue to function (generate activity) for some time after cardiac muscle ceases function in such a state.

[57] D.A. Murphy, G.W. Thompson, J.L. Ardell, et al., *The heart reinnervates after transplanta tion*, in "Annals of Thoracic Surgery," 69, 2000, p. 1769-1781.
[58] L.J. Dell'Italia, J.L. Ardell, *Sympathetic nervous system in the evolution of heart failure*, in *Basic and Clinical Neurocardiology*, edited by J.A. Armour and J.L. Ardell, p. 340-367.
[59] J.A. Armour, *Anatomy and function of the intrathoracic neurons regulating the mammalian heart*, in *Reflex Control of the Circulation*, edited by I.H. Zucker and J.P.Gilmore; D.F. Chechet- to, *Forebrain Control of Healthy and Diseased Hearts*, in *Basic and Clinical Neurocardiology*, edit ed by J.A. Armour and J.L. Ardell.

XII. *Perspectives*

> "While you are proclaiming peace with your lips, be careful to have it even more fully in your heart."
> (St. Francis of Assisi)

Heisenberg posed that one must renounce the idea that natural phenomena obey exact laws as determined by principles of causality. He regarded formal proof of direct causation with respect to trying to understand natural phenomena to be suspect logically.[60] In other words, reductionism that leads to principles of causality may be incapable of generating biological proofs. An excellent example of this notion is represented by the emergent properties displayed by the cardiac neuronal hierarchy. The idea that natural phenomena obey principles of causation that can be derived from studying individual cell lines or even organs removed from the body may, in fact, be as relevant as assessing the nature of a building's structure by determining the properties of its bricks. That our wonderfully designed cardiac muscular pump[61] possesses its own holistic control system may be fundamental to appreciating the heart's capacity to meet daily bodily demands. Furthermore, that that internal nervous system is capable of processing information from multiple internal organs along with centripetal (to the brain) and centrifugal (from the brain) information in the maintenance of the *milieu intereur* represents a novel perspective with which to understand the totality of the human body.

Acknowledgements

The author gratefully acknowledges the financial support of the Canadian Insti- tutes of Health Research and the Canadian Heart and Stroke Foundation.

[60] W. Heisenberg, *Physics and Philosophy*. *The Revolution of Modern Science*, New York, Harper, 1958.
[61] J.A. Armour, W.C. Randall, *Structural basis for cardiac function*

Determining Death: Is Brain Death Reliable?

RAINER BECKMANN*

Brain death has been acknowledged as a criterion for death in most states worldwide. Nevertheless, discussion continues whether brain death is a valid sign of the death of the human being. Especially in jurisprudence, it is necessary to have a clear distinction between life and death, because the legal rights of the living and the dead are fundamentally different. Not only questions concerning the termination of treatment or organ transplantation, but also many civil and social claims depend on a precise determination of death.[1]

I. From Life to Death – in Search of the Borderline

Looking for the borderline between life and death**,** we first have to make some basic considerations, such as dealing with dying as a process, the development of the discussion about brain death and its structural levels**,** and judicial competence in this field.

1. Dying as a Process - Death as a Specific Moment

Life can be recognized by observing diverse expressions of life, like the physical or intellectual activities of a human being. In the prime of life, human beings are particularly able to reach a high-performance level both physically and mentally. When approaching death, the output curve of man gradually declines. Close to death, the mental abilities decline, and the body becomes weaker and weaker. But there is still a significant legal difference between a decrepit person and a dead body. Legally, dying pertains to life. There is no third state of being between life and death. Death is regarded as a specific event in time, which cannot be anticipated, but can only be determined to have already occurred.

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[1] For example, all rights and obligations in civil law get passed onto the heirs (§ 1922 BGB - *German Civil Code*), and relatives may acquire claims on a widow's pension or an orphan's social benefit (s. §§ 46, 48 SGB VI - *German Social Lawbook* VI).

There is a consensus that a conscious person still lives, whereas a body with post mortem lividity, cadaveric rigidity (rigor mortis) or beginning putrefaction is certainly dead. Somewhere within the time between these two states, death is located. When looking for the real point of death, the so-called "vital organs" require special attention. If one of these organs has irreversibly lost its function, and this function cannot be replaced in any other way, death will occur shortly. Parts of the human body, especially cells of the skin, can remain functional ("alive") for many hours or even days. However, a human being is dead before the last cell of his or her body has died.

According to the advocates of the concept of brain death, patients whose respiratory and pulmonary functions are maintained and who still show many signs of life (and no certain "signs of death" like rigor mortis, death stains or putrefaction) are dead. To them, brain-dead patients are corpses. The World Medical Association qualifies a brain dead organ donor as a "cadaver."[2] Whether this is correct must be clarified.

2. Development of the Discussion

Some decades ago**,** the criterion of death was the cessation of respiration and heartbeat. After discovering the techniques of resuscitation,[3] this condition has become principally reversible. Under favourable circumstances, i.e. particularly quick rescue interventions, the autonomous function of the vital organs can be restored. Therefore, only the 'irreversible' end of respiration and heartbeat, which subsequently leads inevitably to the destruction of brain tissue and the death of all other organs, is regarded as death.

Since the invention of mechanical ventilation (respiratory devices), the circulation of oxygenated blood can be maintained artificially, even if the loss of brain activity is irreversible or cannot be prevented. Therefore, in August 1968, a Committee of the Harvard Medical School defined 'brain death' as "a new criterion for death."[4] The World Medical Association adopted this new criterion in the same month.[5], which was also accepted in Germany. Supported by statements and guidelines of the Federal Chamber of Physicians, the new criterion practically became the

[2] See World Medical Association (WMA), *Declaration on Death*, adopted by the 22nd World Medical Assembly in Sydney, Australia, August 1968 (amended by the 35th World Medical Assembly in Venice, Italy, October 1983), no. 2 b and 5.

[3] Cf. *Lexikon der Bioethik*, edited by W. Korff et. al., 2000: entry *Reanimation*, vol. 3, p. 149 ff.

[4] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death*, in „Journal of the American Medical Association", 205, 1968, pp. 337-340 (p. 337).

[5] See World Medical Association (fn. 2).

officially recognized definition of death.[6] Without noticeable resistance, the greater part of jurisprudence joined in.[7] However, some philosophers, physicians, and legal professionals still express their reservations about the criterion of brain death.

The biological process of dying can be arrested for some days while the functions of the lungs and the heart are maintained. If the patient involved is a pregnant woman, she can be kept alive for months until the unborn child can be delivered. In Germany, the events accompanying the so-called 'Erlanger Baby' brought the problem of brain death to public awareness in 1992.[8] While many people could not believe that a team of doctors wanted to deliver an unborn child that was living in a 'corpse' to term, others demanded to let its mother 'pass away in peace'. Are brain dead mothers that carry unborn children to term really dead?[9]

3. Dimensions of Death: Subject, Definition, Criteria, and Tests

When dealing with the issue of man's death**,** different aspects have to be considered.[10]

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[6] Wissenschaftlicher Beirat der Bundesärztekammer (*Scientific Board of the Federal Chamber of Physicians*), *Criteria of Brain Death*, in „Deutsches Ärzteblatt", 1982, p. 45; 1986, p. 2940; 1991, p. 4396; 1993, p. 2933; 1997, p.
1296; 1998, p. 1861. Also, the Catholic and the Protestant Churches in Germany accepted the brain death criterion in a joint declaration (Deutschen Bischofskonferenz /Rat der Evangelischen Kirche in Deutschland, *Gott ist ein Freund des Lebens - Herausforderungen und Aufgaben beim Schutz des Lebens*, Trier, 1989, p. 104).

[7] See W. Höfling, *Um Leben und Tod: Transplantationsgesetzgebung und Grundrecht auf Leben*, in „Juristenzeitung" 1995, p. 28 f. In 1989 H. W. Opderbecke wrote that the debate on a new definition and determination of death „could be deemed finished." There were no more disputes between jurists and physicians about identifying death with brain death (H.W. Opderbecke, *Grenzen der Medizin - Grenzen der Krankenhausversorgung - aus ärztlicher Sicht*, in „Das Krankenhaus", 1989, p. 305).

[8] This case took place in the city of Erlangen and evoked high public interest. Concerning the legal circumstances, see R. Beckmann, *Die Behandlung hirntoter Schwangerer im Licht des Strafrechts*, in „Medizinrecht", 1993, p. 121 ff.; E. Hilgendorf, *Zwischen Humanexperiment und Rettung ungeborenen Lebens - Der Erlanger Schwangerschaftsfall*, in „Juristische Schulung", 1993,
p. 97 ff.; D. Giesen, J. Poll, *Recht der Frucht/Recht der Mutter in der embryonalen und fetalen Phase aus juristischer Sicht*, in „Juristische Rundschau", 1993, p. 177 ff.

[9] The first documented case in Germany of a successful pregnancy in a brain dead-mother took place in a hospital near Stuttgart in 1991. After diagnosis of brain death, the mother was kept alive for 71 days. The child was born in the 29th week of pregnancy. See K.-E. Siegel, *Wir durften nicht aufgeben - Ein Vater schildert die letzten Monate der Schwangerschaft seiner hirntoten Frau und die Geburt seines Sohnes*, 1993; P. Bavastro, J. Wernicke, *Eine besondere Krankengeschichte*, in „Zeitschrift für medizinische Ethik", 1997, p. 59 ff.

[10] For the following, see M. Kurthen, D. Linke, D. Moskopp, *Teilhirntod und Ethik*, in „Ethik in der Medizin" 1989, p. 137 ff.; M. Kurthen, D. Linke, M. Reuter, *Hirntod, Großhirntod oder personaler Tod?*, in „Medizinische Klinik", 1989, p. 483; M. Kurthen, D. Linke, *Vom Hirntod zum Teilhirntod*, in *Wann ist der Mensch tot?*, edited by J. Hoff, J. in der Schmitten, Reinbek b. Hamburg, 1994, p. 83 f.; D. Birnbacher, H. Angstwurm, F.W. Eigler, et al., *Der vollständige und endgültige Ausfall der Hirntätigkeit als Todeszeichen des Menschen - Anthropologischer Hintergrund*, in „Deutsches Ärzteblatt", 1993,
p. 2170 ff.; W. Höfling, *Um Leben und Tod: Transplantationsgesetzgebung und Grundrecht auf Leben,* in „Juristenzeitung" 1995, p. 30. In international

(1) There is the question of the *subject* of death: Who is dying? This starting point reveals that neither the death of all *cells* of the human body nor the death of one *organ* (like the brain) can simply be identified with the death of the human being, because these "deaths" refer to different subjects.

(2) We have to consider the *definition* of death: What is death? This second aspect is based on the first. Depending on *whose* death is defined, one will come to different definitions of death. Abstractly speaking, death occurs when all (still to be specified) features of the definition are fulfilled. But in practice, we have to face the problem that the signs of life are manifold and need more or less time to cease - depending on the circumstances of death. During this process of dying, death occurs at a certain point in time.

(3) It has to be discussed which *criteria* show us that death has already happened (regarding a specific subject): What is a certain indication or sign of death? Such a criterion (sign) is, for example, the stiffening of the body (rigor mortis). Whether brain death is a sign of death with the same degree of certainty must be examined. A sign of death is not meant to describe or fix the true moment of death, but to indicate that death has already occurred.[11]

(4) *Tests* can be specified, which show that a criterion of death is fulfilled, and therefore death has been proven: How can death be verified? Concerning brain death**,** the Federal Chamber of Physicians has explained such tests in several statements.[12]

These four 'dimensions of death' cannot be considered isolatedly. Clinical tests only make sense if the criterion to be proven is previously known; a criterion of death is always based on a specific definition of death; finally, the definition depends on the subject whose death shall be determined.

4. Judicial Competence

When considering the different dimensions of the problem, it is perfectly clear that there is no exclusive medical competence in this field.[13] Only the level of diagnostic tests is based exclusively on scientific- medical knowledge. In this case, medical competence has to be given

debate, sometimes only three dimensions are distinguished (s. S. Laureys, *Hirntod und Wachkoma,* in „Spektrum der Wissenschaft", 2006, p. 63).

[11] Referring to the *Criteria of brain death* of the Scientific Board of the Federal Chamber of Physicians „the moment in which the final diagnostic observations are made" is documented as time of death, because „the actual point of death can not be determined exactly" (see „Deutsches Ärzteblatt", 1982, p. 52).

[12] See fn. 6.

[13] Thus we cannot accept the statement of Pope Pius XII. in March 24th, 1957. He said that it is „a matter belonging to the physician and esp. the anaesthesiologist to give a clear and precise definition of death" (s. Pius XII, *De reanimatione*, in „Acta Apostolicae Sedes", 49, 1957, p. 1031).

priority. This, however, is not the case with regard to the other three aspects of the description of human death. What makes a human being a human being, what we understand by „death," and which criteria indicate with acceptable certainty that death really took place are questions that must be examined from the point of view of several scientific disciplines. Human dignity (art. 1 par. 1 GG[14]) and the right to life (art. 2 par. 2 s. 1 GG) are the legal basis on which jurisprudence must contribute to the above mentioned questions. With respect to the enormous legal consequences following death, it is the task of jurisprudence to scrutinize the consistency of the definition and the criteria of death. If there are substantiated doubts about the validity of a criterion of death, we have to make the assumption that this particular criterion does not indicate the death of a human being with the required certainty.

II. Brain Death – a Valid Criterion of Death?

Whether brain death can be acknowledged as a valid sign of death is dependent on several circumstances: is brain death based on an appropriate image of man, does a reasonable definition of death rest upon this image, and does the concept of brain death really cover the features of the definition? The question whether the commonly used clinical tests really exclude any brain activity in 'brain-dead' patients (see above) is not the subject of this investigation. The doubts, in this case, have to be examined by medical experts.

1. Definition and Reasons of the Criterion of Brain Death

The prevailing definition of brain death both world wide and by the Federal Chamber of Physicians in Germany refers to the cessation of all functions in the whole brain (cerebrum, cerebellum and brain stem). The World Medical Association requires "the irreversible cessation of all functions of the entire brain, including the brain stem."[15] Accordingly, the Scientific Board of the Federal Chamber of Physicians states:

> Brain death is the complete and irreversible collapse of the overall function of the brain while a circulatory function is still being maintained in the rest of the body. Without exception, this is applied to patients who have to be ventilated and monitored because of the absence of spontaneous breathing. Brain death is the death of man.[16]

14 GG = Grundgesetz (German Basic Law = The German Constitution).

15 World Medical Association (fn. 2), no. 4.

16 Scientific Board of the Federal Chamber of Physicians, *Criteria of Brain Death,* in „Deutsches Ärzteblatt", 1982, p. 45; 1986, p. 2940.

In contrast to so-called 'brain stem death' and 'neocortical death', both the neocortex (the cerebral hemispheres), which is said to be the place where human consciousness is located, and the brainstem, which controls breathing and many other vitally important processes in the human body, must be irreversibly destroyed.

The declaration of the World Medical Association on brain death does not include any direct reason why brain death should indicate the death of a human being. We can only deduce indirectly that the World Medical Association is concerned about the "fate of a person" instead about the life of cells and that the irreversibility of the dying process is of decisive importance.[17]

The reasons given by the German Federal Chamber of Physicians are a little bit more explicit:

> With the death of the organ brain, the indispensable conditions for any personal human life as well as all necessary controlling processes for an independent physical life have definitely ceased. The observation of brain death therefore means the observation of the death of man.[18]

These two sentences contain all the reasons for brain death in the original *Criteria of Brain Death* of the Federal Chamber of Physicians from 1982. They were repeated in the first amendment in 1986.[19] The second amendment of 1991, which mainly included some technical developments concerning the tests, does not mention the reasons for brain death at all. Up to this time, the acceptance of brain death seemed so undisputed that there was no need to offer a deeper explanation. In 1993, for the first time, the Scientific Board of the Federal Chamber of Physicians published its own support of the original short explanation on brain death: *The Definite Cessation of all Functions of the Brain ('Brain Death') as a Valid Sign of Death*[20]. The Board focuses on the biological component of brain death. An organism has to be considered dead, „if the particular functions of its organs and systems as well as their interrelations are no longer assembled to a superior living entity as a functional whole and have irreversibly lost its control."[21] The Board added that the destruction of the brain also means "the loss of the somatic basis" of man's "physical-spiritual existence in this world."[22]

[17] World Medical Association (fn. 2), no. 3: „But clinical interest lies not in the state of preservation of isolated cells but in the fate of a person. Here the point of death of the different cells and organs is not so important as the certainty that the process has become irreversible …."

[18] Scientific Board of the Federal Chamber of Physicians, *Criteria of Brain Death,* in „Deutsches Ärzteblatt", 1982, p. 50.

[19] Cf. Scientific Board of the Federal Chamber of Physicians, in „Deutsches Ärzteblatt", 1986, p. 2945.

[20] Scientific Board of the Federal Chamber of Physicians, *The Definite Cessation of all Functions of the Brain ('Brain Death') as a Valid Sign of Death,* in „Deutsches Ärzteblatt", 1993, p. 1975 ff.

[21] Ibid., p. 1975.

[22] Ibid.

The *Statement of German Scientific Societies on death due to full and definite failure of the Brain*[23] from 1994 puts even more emphasis on this point:

In man, the brain is furthermore the essential and irreplaceable physical basis for the material non-tangible spirit. Whatever is understood by the human spirit, the human soul and the human person, a human being whose brain has died is no longer able to feel anything from inside or its surroundings, to notice, to observe and to answer, to think, to decide. When the function of his brain has entirely and definitely stopped, the human being in question has ceased to be a being with physical-spiritual or body-soul unity. Therefore, a human being whose brain entirely and definitely stopped to function is dead.[24]

These statements show that brain death is regarded as a valid sign of death, belonging to the third level of the complex 'death' as described above (a criterion of death). The reasons why brain death indicates the death of man with certainty shows us the underlying perception of death (the definition of death; second level). From this perspective again**,** we are able to conclude what kind of subject the supporters of the brain death criterion see involved (subject of death; first level).
According to that**,** the death of man is characterized by two elements: – the loss of the physical basis for the 'spiritual' side of man,
especially the loss of consciousness or 'personal' life and
– the break-up of the functional wholeness of the organism.[25]
From this definition of death, we can draw the conclusion that the subject of brain death is a biological organism capable of spiritual- personal life.

2. Objections to the Criterion of Brain Death

At first sight, the concept of brain death as the complete and irreversible loss of all brain activity seems to be plausible. Does it make sense to talk about a 'living man', when his body is no longer a functional whole and the spiritual component lacks its physical basis? But a second look raises doubts, if brain death really indicates the death of man with highest certainty – like *rigor mortis*, body stains or putrefaction do.

[23] Edited by the *German Societies for Anaesthesiology and Intensive Care, Neurosurgery, Neurology and the German Physiological Society*, printed in „Frankfurter Allgemeine Zeitung", 28 September 1994, p. N 3.
[24] Ibid.
[25] See also the short definition of death by D. Birnbacher, H. Angstwurm, F. Eigler W., et al., *Der vollständige und endgültige Ausfall der Hirntätigkeit als Todeszeichen des Menschen - Anthropologischer Hintergrund*, in „Deutsches Ärzteblatt", 1993, p. 2172: „irreversible loss of consciousness and irreversible loss of the integration of body functions to the whole."

a. Definition with Clear Intention

The introduction of brain death was not the result of reasoning about death in principle. The policy-making *Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death*[26] from 1968 did not include a factual statement about the validity of the new criterion of death. It justified instead the aim of the report – "to define irreversible coma as a new criterion for death"[27] – by giving two reasons for the *need* to have a new criterion:

– First: It is a great burden for patients "who suffer permanent loss of intellect," their families, the hospitals, and "those in need of hospital beds already occupied by these comatose patients." The report hereby addresses the problem of disconnecting life-support systems.

– Second: Obsolete criteria for the definition of death could lead to controversies in obtaining organs for transplantation.[28]

It is obvious that all problems seen by the Harvard Committee – the legitimacy of terminating life sustaining measures and transplanting organs – are solved in one swoop if the patients in question are declared dead.[29] This 'solution' was and still is neither evident nor compelling. The legitimacy of terminating life-support can be regulated in a reasonable way without inventing a new criterion for death. And the need to get 'fresh' organs for transplantation is not related to the question of death.

(1) Brain Death as an Indication for Terminating Life-Sustaining Measures

When resuscitative techniques were still unknown, doctors were unable to stop the process of dying once the supply with oxygen and its distribution in the body had ended. When respiration and blood circulation ceased, „all life in the organism gradually, in ischemic order, died due to the inhibited oxygen supply."[30] The classic criterion of death – loss of cardio-respiratory functions – did not cause any ethical or judicial problems. The patient**,** taken for dead**,** was not treated or medicated anymore (not knowing the reversibility of his status), so that in a short time the brain and all other organs, tissues and cells died as well. If the patient was to be treated as dead – e.g. for post mortem autopsy or burial , enough time had elapsed so that absolutely valid signs of death would develop (rigor mortis, body stains or beginning putrefaction).

[26] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death* (see fn. 4).

[27] Ibid., p. 337.

[28] The report only gives a short reason for the death of an *organ*: „An organ, brain or other, that no longer functions and has no possibility regaining its function is for all practical purposes dead" (ibid.).

[29] Accordingly, the *Scientific Board of the Federal Chamber of Physicians* declares further deliberation about the protection of life after the determination of brain death for „no longer relevant" („Deutsches Ärzteblatt", 1993, p. 2177).

[30] G. Geilen, *Medizinischer Fortschritt und juristischer Todesbegriff*, in „Festschrift für Heinitz", 1972, p. 375.

The criterion of cardio-pulmonary death does not really indicate death, because in many cases resuscitation is possible. In the best cases, spontaneous breathing and heartbeat can be restored. Today, we know that in many cases, people that once were taken for dead could have been rescued. They were not really dead. If they had been treated quickly enough, many of them could have stayed alive. Death occurred not immediately after the end of breathing and heartbeat, but sometime afterwards.

It should be clear that the moment in which the decision to let a patient die is legitimate must not be identified with the moment of death.[31] So it is not convincing to link the question of a legitimate disconnection of life- support machines with the determination of death. To justify ending measures that prolong life, the patient does not have to be dead.[32] Death is only the very last limitation for medical treatment. To let someone die after having tried to rescue him with maximum medical treatment „one doesn't have to know where the exact borderline between life and death lies - we let nature cross it, wherever it may be ...."[33] But if we want to declare someone to be a 'cadaver' and treat him accordingly, we have to be absolutely certain that this line has been crossed.[34]

(2) Brain Death as a Criterion of Organ Transplantation

The possibility of explanting organs as fresh as possible seems to have been the main motive for demanding a new criterion of death. This motive may be respectable – from the viewpoint that successful organ transplantation can save lives. But a noble end does not justify all means; it certainly doesn't justify explanting vital organs if the patient in question is not dead. The question whether brain death is a valid sign of death has to be answered objectively, regardless of any purpose that might be served.

The fact that the declaration of brain death as a new criterion of death was obviously interest-guided is no proof for its incorrectness. Yet it is an indication to examine the later given reasons particularly thoroughly. So we have to consider some more arguments.

[31] See also Scientific Board of the Federal Chamber of Physicians, *The Definite Cessation of all Functions of the Brain ('Brain Death') as a Valid Sign of Death,* in „Deutsches Ärzteblatt", 1993, p. 1976: „Man is not yet dead when his treatment is hopeless and his recovery impossible."

[32] See J. Hoff, J. in der Schmitten, *Kritik der Hirntod-Konzeption,* in *Wann ist der Mensch tot?,* edited by J. Hoff, J. in der Schmitten, Reinbek b. Hamburg, 1994, p. 188 ff.; *Lexikon der Bioethik,* edited by W. Korff et. al., 2000, entry *Behandlungsverzicht/Behandlungsabbruch*, vol. 1, p. 312 ff.

[33] H. Jonas, *Technik, Medizin und Ethik. Zur Praxis des Prinzips Verantwortung,* Frankfurt a.M., 1987, p. 221.

[34] Cf. ibid.

b. Logical Inconsistency

The definition of death, on which the brain death criterion is based, is not logically linked to the subject of death. If being a human is characterized by having a conscious and personal life, including a spiritual aspect of existence, as well as to be a biologically integrated body as a whole, then death should be acknowledged to have occurred when one of these components is missing. As most scientists attribute the specific spiritual expressions of life to the activities of the upper hemispheres of the brain (cerebrum; neocortex), the functional breakdown of these regions of the brain had to be defined as human death.[35]

On the other hand, it is not quite comprehensible what additional condition for human life the function of the cerebrum should constitute, if a 'mere biological' life of a human organism including brain stem functions is sufficient to assume the existence of a living human being. For according to the 'whole-brain death'–criterion the loss of function in the brain stem alone is not considered as the death of man.

The whole-brain death criterion and the definition of death that lies behind it do not reflect the supposed subject of death. The criterion demands requirements for the determination of death which are not necessary with respect to the assumed subject of death. At heart, the whole-brain death criterion is a concept of part-brain death that is ill- conceived.[36]

c. Does the Brain Death Criterion Convincingly Indicate the Features of Death?

Finally, we must investigate whether the brain death criterion really indicates the features of death:

– the loss of the physical basis for 'spiritual' life and

– the break-up of the functional wholeness of the organism (see above).

(1) Loss of the Physical Basis for 'Spiritual' Life?

If 'spiritual' life means a truly non-material ("materially non- tangible"[37]) level, this part of the reasoning for the brain death criterion is not convincing. Why should a non-material or spiritual level be exclusively linked to the (whole) brain? That something non-material could be exactly located in a certain area of the body seems to be quite

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[35] Some authors really argue this way. Up to now they didn't succeed in convincing the scientific community; see S. Laureys, *Hirntod und Wachkoma,* in „Spektrum der Wissenschaft", 2006, p. 67 f.

[36] See M. Kurthen, D. Linke, D. Moskopp, *Teilhirntod und Ethik*, in „Ethik in der Medizin" 1989, p. 140. That does not mean that cerebral (neocortical) or brain stem death concepts are more convincing. A neocortical concept f. i. would be quite counterintuitive, because it allows to bury or to incinerate people in 'persistent vegetative state' while still breathing (s. ibid., p. 139, 141).

[37] See the citation at footnote 24. This quotation makes clear that many medical experts go beyond their field of expertise when discussing brain death. Statements on "the materially non-tangible spirit" can be made with more authority by scientists from other disciplines, esp. philosophy or theology.

unlikely. In any case, medicine never produced evidence where to find the 'seat' of the spiritual side of man. Until the proof of the contrary, we have to assume that a 97-percent-living body can absolutely be the material basis of a non-physical level.[38]

If the brain as "the essential and irreplaceable physical basis of the materially non-tangible spirit" no longer functions, this spirit is without any doubt not able to have the effects which are based on the brain – like thinking, communication etc. But this impossibility for the spirit to have effects does not coercively rest upon the non-existence of the spirit.[39] Furthermore, it seems impossible to prove the existence or the non- existence of something "materially non-tangible" by means of natural science, like the tests carried out to prove brain death.

If the loss of brain function implies the absence of the human spirit, and if this absence permits to declare a human being dead, then human embryos also pass for being 'dead' until the development of the brain. But this is not plausible. The early embryo is obviously not dead; he is very much alive, so alive that he is able to generate a brain.

(2) Are Achievements based on Consciousness Decisive?

The first component of death (according to the whole-brain death criterion), could also have another meaning. The features "personal life,"[40] „consciousness"[41] etc. could represent several consciousness- based performances of the brain like "thinking," "perception," "communication" … These abilities are the topic of neurology and brain research, but cannot be explained in their deepest meaning by natural science alone. An EEG, for example, can prove electrical activity in the brain but not "consciousness." Modern medicine – including neurology – is not able to define "consciousness," "thinking," "person" or to measure these entities with its specific tests and methods.[42]

All that medicine can do is to measure electrical activity in the nervous system and the cells of the brain, which is interpreted as materialized effects of "consciousness" etc. But if this performance of

[38] See also Thomas of Aquinas, *Summa Theologiae*, Ia, q. 93 a. 3 co.: "Anima hominis est tota in toto corpore eius, et iterum tota in qualibet parte ipsius."

[39] Perhaps an example from Robert Spaemann, used in a different context, can illustrate this idea (see R. Spaemann, *Person ist der Mensch selbst, nicht ein bestimmter Zustand des Menschen*, in *Menschlichkeit der Medizin*, edited by H. Thomas, Herford, 1993, p. 270): If someone says: „I can play the piano", and he is asked to do so, but there is no piano, then the capacity of playing piano is still there, even if it is not possible to perceive it for lack of the instrument.

[40] Scientific Board of the Federal Chamber of Physicians, *The Definite Cessation of all Functions of the Brain ('Brain Death') as a Valid Sign of Death*, in „Deutsches Ärzteblatt", 1982, p. 50.

[41] D. Birnbacher, H. Angstwurm, F.W. Eigler, et al., *Der vollständige und endgültige Ausfall der Hirntätigkeit als Todeszeichen des Menschen - Anthropologischer Hintergrund*, in „Deutsches Ärzteblatt, 1993, p. 2172.

[42] M. Kurthen, D. Linke, D. Moskopp *Teilhirntod und Ethik*, in „Ethik in der Medizin", 1989, p. 139: „How could brain structures be assigned to be f. i. 'responsible for thinking', if there is not even a consensus about what 'thinking' really is?"

the brain is all there is, like the brain death criterion seems to imply, then our reasoning becomes circular: what must be proved to have ceased ("personal life," "consciousness") is already part of the criterion which is supposed to produce evidence (loss of all measurable brain functions).

(3) Disintegration of the Human Body as a Whole?

Finally, we have to answer the question whether the destruction of the brain – including the brain stem – really means the end of the functional wholeness of the human organism.
According to the statement of the Scientific Board of the Federal Chamber of Physicians in 1993, brain death has the following biological consequences for a human being:

> the complete and irreversible failure of the entire brain means biologically the loss of the
>
> - independence of the self as a functional unit, as a whole (autonomy as an organism) [1]
> - independent activity as a functional unit, as a whole (spontaneity as an organism) [2]
> - coordination and selection of particular functions of the functional unit of the whole (controlling through the organism) [3]
> - interrelationship between the whole as a functional unit and its surroundings (assimilation and segregation as a whole) [4]
> - combination of the particular functions and their interrelations to the whole as a functional unit (integration) [5].[43]

Strictly speaking, this addresses the significance of the brain stem for the human organism, because according to the concept of whole-brain death, a functioning brain stem is sufficient to acknowledge a living person.[44] Consequently, it has to be examined whether the brain death criterion really indicates the loss of the "functional wholeness" of the organism in all its particular details. The existence of the above mentioned integrating features of brain activity have to be assessed as signs of life, their absence as signs of death.

> – The first feature which should indicate the end of the "organism in its functional wholeness" – the loss of "independence" in terms of autonomy [1] - is still present when the brain stem has ceased to function. Even if some control functions are taken over by a support machine, this does not take away (restricted) autonomy from the organism. The organism still is differentiated from its surroundings and can be recognized as a unit. It does not become part of another organism.

[43] Scientific Board of the Federal Chamber of Physicians, *The Definite Cessation of all Functions of the Brain ('Brain Death') as a Valid Sign of Death,* in „Deutsches Ärzteblatt", 1993, p. 1975.

[44] The cerebral hemispheres do not appreciably contribute to the biological functioning of the human body. There are people suffering from apallic syndrome who can live for many years without technical support (cf. *Lexikon der Bioethik,* edited by W. Korff et. al., 2000: entry *Apallisches Syndrom*, vol. 1, p. 184 ff.).

– In a brain dead person, the features "spontaneity" [2] and "controlling" [3] are reduced compared with a patient with an active brain stem. When the brain stem no longer functions, spontaneous breathing and the production of important hormones cease. Artificial ventilation and medication are necessary to prolong life. In other cases, dependency on technical and medical support (even on artificial organs), surrogate substances or medication is not the ground to declare patients who need such a treatment as dead.[45] Why should we do this with patients whose brain stem lost its function, if these functions can be replaced by a ventilating machine and certain hormones?[46] Basically the brain is an organ like any other organ. As far as its functions can be substituted by intensive-care treatment, this case has to be judged like, for example, the implantation of an artificial heart. Whether an organ is able to contribute to the life of a human being spontaneously or whether it is supported by technical means (like a cardiac pacemaker), by artificial replacements of organs or its parts (like cardiac valves; artificial heart), can not be decisive. There is no absolutely exceptional role of the brain concerning "self-activity" and "controlling." Surely the brain stem is 'vital', and it is essential for breathing. But the advocates of the concept of brain death do not see that the brain keeps the human being alive only in interaction with all the other vital organs: heart, lungs, kidneys etc. From a systemic- biological point of view, the brain not only keeps heart, lungs, kidneys etc. alive, but these organs also keep the brain alive. The brain can therefore not be seen as the absolutely decisive instance for the maintenance of life in a human being[47].

– Furthermore, we find many interrelations between brain-dead persons and their surroundings [4]. A brain-dead organism reacts in limited ways to stimuli from outside. So blood pressure increases after the first incision of the surgeon when he starts the explantation of an organ.[48] Hence organ donors are given drugs for muscle relaxation before explantation. Other reactions of brain-dead persons are, for example, the so-called "Lazarus-Syndrome"[49] (walking movements) or the hugging of nurses when they raise the head of the patient in order to arrange the

[45] J. Hoff , J. in der Schmitten, *Kritik der Hirntod-Konzeption*, in *Wann ist der Mensch tot?*, edited by J. Hoff, J. in der Schmitten, Reinbek b. Hamburg, 1994, p. 188 ff.

[46] G. Roth, U. Dicke, *Das Hirntodproblem aus der Sicht der Hirnforschung*, in *Wann ist der Mensch tot?*, edited by J. Hoff, J. in der Schmitten, Reinbek b. Hamburg, 1994, p. 54.

[47] Ibid., p. 53.

[48] R.D. Truog, *Is it Time to Abandon Brain Death?*, in „Hastings Center Report" 27, 1997, pp. 29-37 (p. 30); H. Schlake, K. Roosen, *Der Hirntod als der Tod des Menschen*, Neu Isenburg, 1995, p. 48; *Bundestags-Drucksache* 11/7980, p. 32.

[49] D. Linke, *„Hirntod" und die Folgen*, in *Menschlichkeit der Medizin*, edited by H. Thomas, Herford, 1993, p. 102.

pillow.[50] Are these utterances of life 'worse' than the cough reflex or the blinking reflex, which are executed by the brain? Why should a brain- dead person be dead, an almost brain-dead person however still be alive, simply because his oculocephalic reflex functions?[51] A human being whose brain stem functions are maintained (and therefore still is alive - according to the brain death criterion), does not show considerably stronger interactions with its surroundings than a brain-dead human being with no functions left in the brain stem.

—Finally, we have to ask whether the body of a brain-dead person has the ability of integration, of building a functional unit [5]. This ability indeed seems to be a characteristic of a living organism. "Living systems" always strive to reach an organized state. They are capable of integration, of self-organisation.[52] In contrast, "non-integrative 'dead' systems always approach a state of maximum disorder or dissipation (entropy)."[53]

A brain dead person whose breathing is artificially supported is not an organism that only constitutes an accumulation of organs that is left to proceeding decay. An increasing disorganization of the organs, the tissues and cells of the body cannot be observed. On the contrary, there is considerable order and integration: the spinal cord,[54] temperature control, blood circulation, metabolism, the immune system and the gas exchange in the lungs function.[55] Pregnant women are even capable of giving birth to a child. Especially this fact shows that very complex interactions between several organs (heart, lungs, liver, kidneys etc.), i.e. *integration*, is happening. "The continuation of a pregnancy hardly belongs to the natural performance of an air-pump, a nutrient infusion and some circulation-stabilizing drugs."[56] Why should the astonishing capacity of carrying a child to term receive less respect than any other integrating process linked to the brain?[57]

[50] D. Linke, in *Hirntod und Schwangerschaft*, edited by G. Bockenheimer-Lucius, E.Seidler, Suttgart, 1993, p. 91.

[51] M. Kurthen, D. Linke, D. Moskopp, *Teilhirntod und Ethik*, in „Ethik in der Medizin" 1989, p. 484. The oculocephalic reflex is the reflective movement of the eyeballs when the head is suddenly moved.

[52] J. Hoff , J. in der Schmitten, *Kritik der Hirntod-Konzeption*, in *Wann ist der Mensch tot?*, edited by J. Hoff, J. in der Schmitten, Reinbek b. Hamburg, 1994,
p. 182.

[53] Ibid.

[54] Responsible for the above mentioned regulation of blood pressure and the control of reflective movements of the limbs.

[55] A dead body could only be *blown up.* See P. Bavastro, J. Wernicke, *Eine besondere Krankengeschichte*, in „Zeitschrift für medizinische Ethik", 1997,
p. 63.

[56] H. Thomas, *Sind Hirntote Lebende ohne Hirnfunktionen oder Tote mit erhaltenen Körperfunktionen?*, in „Ethik in der Medizin", 1994, p. 195.

[57] Accordingly, in the case of the 'Erlanger Baby', the local court installed a guardian for the mother (AG Hersbruck, in „Medizinrecht", 1993, p. 111), which in civil law is provided for only for living persons. This makes clear that apparently lawyers and judges are reluctant to treat brain-dead people like corpses or 'cadavers'.

The organism of a brain dead person is maintained practically "as a whole" – minus the brain. The individual organs remain connected and alive – just the way transplantation medicine wants them. Coordination and integration can still be recognized and constitute a coherent human body. Disintegration does not take place. Medical interventions prevent decay and putrefaction. Only if life supporting measures are terminated, disintegration quickly spreads.
The state after the final decay and the state prior to it have to be distinguished. They are of different quality. After the death of the organ brain, man is very close to death. He is dying. The reduced but nevertheless still prevailing capacity of integration in the body of a brain- dead person is a respectable sign of life. In this state, it is therefore not appropriate to declare a human being dead and to treat him like a corpse.

IV. Conclusion

A brain-dead human being is not a 'cadaver,' as the World Medical Association put it. The features of death, i.e. the end of the physical- spiritual unity and the biological unity of the organism as a whole, are not reliably indicated by the brain death criterion. Statements about the end of the "physical-spiritual unity," which are based only on scientific tests, seem principally questionable, and the death of the human organism as a whole can be reasonably doubted. These doubts have to be cleared by those who claim a right to intervene into the bodies of brain- dead people. The loss of brain function alone cannot be considered a valid sign of death.

*A Brief Summary of Catholic Doctrine. Regarding Human Life*** FABIAN W. BRUSKEWITZ

It is the intention of the author of this paper to ask some questions aris- ing from the theological outlook and pastoral practices of the Catholic Church in regard to "the signs of human death" and to situate questions that are asked in the midst of a brief summary of Catholic doctrine regarding hu- man life.

All of this, of course, is in relationship to a relatively new concept called 'brain death'. This concept originated in the United States with the publica- tion of the Report of the 'Ad Hoc' Committee of the Harvard Medical School to Examine the Definition of Brain Death.[1] The principal motivation was, as I understand it, to make possible the transplantation of human unpaired vi- tal organs from people who are still breathing (albeit supported with a ven- tilator) and whose hearts are still beating. The question, then, would be, does the death of a human being equal the complete cessation of life of the or- ganism or is it possible and legitimate to understand partial or local destruc- tion (necrosis) of the brain as the equivalent of death? So long as the necro- sis involves the cerebrum, the cerebellum, and the brain stem, the four basic theological questions that arise from this assertion of 'brain death' are:

First, are we certain of the equivalence between theological death and 'clinical' death?

** For presentation at the Conference on the "Signs of Death," The Pontifical Academy of Sciences, Vatican City, February 3-4, 2005.

[1] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death*, in "Journal of the American Medical Association," 205, 1968, p. 337-340.

Second, in what sense can Catholic doctrine be understood as consistent when it is considered immoral by well-founded moralists to destroy for the purpose of medical research, or even implantation or transplantation hu- man zygotes, blastocysts and embryos that do not have brain cells or brain waves?
Third, is there sufficient moral certitude about 'brain death' being the same as theological death to enable one to overlook the standard moral teach- ing that moral theological manuals have in unanimity that one is not allowed to act in certain doubts of fact? In doubt of law, one can follow a well-found- ed opinion, following what is called 'probabilism', but in certain doubt of fact, it appears that there needs to be, unless absolute urgency requires it, no act.
Fourth, the question arises as to the definition of the sin and crime of de- liberate homicide, and this issue also appears to me to need significant ex- ploration.

I.

Is clinical death (absence of heartbeat, pulse, blood pressure, respiration, movement and reflexes) the equivalent of theological death? There has been in Catholic pastoral practice, for many generations, a great deal of skepticism about such equivalence. This is the reason why Catholic moral theology man- uals, as well as manuals of pastoral theology, instruct priests about their right and possible duty, conditionally to absolve and anoint people even after ap- parent clinical death, and even after official, legal declarations of death by as- serting the condition, "If you are alive, I anoint you...I absolve you, etc.."
It had been a 'rule of the thumb' for pastoral practice that this could be done even up to an hour after the cessation of respiration and circulation, and, indeed, some have extended this even up to a period of two hours, par- ticularly if the death was sudden and of a young and healthy person. It might be noted that it is particularly those kinds of persons, that is, young and healthy who die suddenly, especially from incidents such as unexpected brain traumas, either by accident or disease, who are the most sought-after candi- dates for unpaired vital organs for transplantation.
Occasionally, an extreme anecdote can be brought forward, and while not usual, it nonetheless serves to illustrate the point I am making. T.K. a four- year-old boy was declared 'brain dead'. This person continued to live with

the support of a ventilator for more than 15 years. His heart was beating and his blood circulating. There was exchange of oxygen and carbon dioxide in his lungs and throughout all tissues of his body via circulation. He was di- gesting food and excreting waste, and he was responding to external stimuli. All of these are characteristics of people who are proclaimed to be "brain dead," and suitable for having their unpaired vital organs removed and trans- planted into someone else. Not only did he have these signs of life, but also he grew through puberty into adulthood. Careful evaluations with MRI showed no evidence of intracranial blood flow. The remnants of brain were atrophic and unable to be recognized as brain.[2] One must question, I believe, theologically whether T.K.'s body and soul had definitively separated. If neu- rological criteria alone are sufficient to determine the life or death of a per- son, one must ask what was present in the breathing body of T.K. for more than a decade. Are we certain, with moral certitude, that the declared 'brain death' made this breathing person a corpse and a cadaver and no longer a liv- ing human being? Do we have absolute moral certitude that the brain is the single integrating organ of a human person? We do know, of course, that adult stem-cells can continue to live and the destruction of all cells in a hu- man body has never, as far as I know, been considered necessary for an un- derstanding of theological death. On the other hand, the separation of the immortal human soul from the human body has, at least in past generations, been treated with a great deal of humble uncertainty on the part of both be- lieving scientists, including neurologists and cardiologists, as well as by the- ologians, and for this reason, there has always been, in pastoral practice and theological belief, an inclination to be particularly cautious about the precise moment of theological death. In his address on August 29, 2000, to the Eigh- teenth International Congress of the Transplantation Society, our Holy Fa- ther, Pope John Paul II, spoke about "clearly determined parameters com- monly held by the international scientific community in regard to death." He spoke about the need to ascertain before unpaired vital organs are removed from a person "complete and irreversible cessation of all brain activity." (This was pointed out to include the cerebrum, cerebellum and brain stem). Now, the question I would ask, do any "clearly determined parameters commonly held by the international scientific community" really exist? My research in- dicates that there are no such commonly held and clearly determined para-

[2] D.A. Shewmon, *Chronic 'Brain Death': Meta-analysis and Conceptual Consequences*, in "Neu- rology," 51, 1998, p. 1538-1545.

meters. As a matter of fact, 'brain death' is defined in a myriad of ways and there are dozens of various 'parameters' circulating in the scientific community, and, as a matter of fact, there is a growing number of scientists, it appears, who have brought forth an enormous variety of definitions of 'brain death'. Furthermore, as has been pointed out, the only way in which one can understand "complete and irreversible cessation of all brain activity" would be that the doctor would be able to know that the cerebrum, cerebellum, and brain stem are destroyed. Otherwise, how could he know that they could never recover any function whatsoever?

Another question that would certainly have to be asked, as I have done in the past,[3] is: how does one determine irreversibility? Irreversibility is not an empirical concept, nor an observable condition. It can only be at best, a deduction from a set of symptoms. In an address entitled *Brain Death and Eu- thanasia*, Josef Seifert states:

We must also remind ourselves of an empirical proof of the uncertainty of our knowledge concerning the time of death. Think of the life after life experiences of people who were declared clinically dead and still had all sorts of experiences asso- ciated with their bodies. Can we be certain that *brain dead* persons could not be in a similar state prior to the occurrence of actual death? The actions of organ har- vesting are based on the assumption that the event of death has occurred prior to a certain moment and can be determined with moral certainty by the medical profes- sion before the natural phenomenon of death, with all its obvious features, has set in. Death in this classical sense does not just involve irreversible cardio-pulmonary arrest, but is accompanied by many other well nigh indubitable signs from the ces- sation of all vital functions to the frigor (coldness) of death to the rigor mortis of the corpse to the actual decomposition of the body. Even when faced with the whole body of death, one, it seems, should wait for time after actual death sets in before one dissects a corpse. To declare death when the first undoubted marks of death have set in is not presumptuous, yet to act or to dissect a corpse on the first decla- ration of death is presumptuous. It is more than pretentious, moreover, to determine the occurrence of death by means of a mere set of scientific facts and theories about the portion of body tissue which contains the person while the body as a whole still lives.

[3] W. Bruskewitz, *Are Organ Transplants Ever Morally Licit?*, in "Catholic World Report," March 2001.

II.

A consistent pro-life argument that is in conformity and compatibility with perennial Catholic doctrine regarding human life would also argue, at least to some extent in my view, about the usage of encephalic or neurological criteria solely being used for a determination of clinical death. Human zygotes, human blastocytes and human embryos do not have brains or brain function. Disputes about hominization or the ensoulment of a human being at the beginning of life on earth are obviously tied in at the other end of life on earth with disputes about the definition of human death. I would, for a discussion of hominization and a proposal of immediate hominization from the systems perspective refer you to an article by the Reverend Nicanor Pier Giorgio Aus-triaco, O.P., in the "National Catholic Bioethics Quarterly," winter 2002 issue. Simply, to summarize Father's paper would be impossible at this time, but he does conclude by saying he has responded to a challenge made to Catholics

to reconcile the theory of immediate hominization with the philosophical princi- ples that are rooted in Catholic tradition by advancing a philosophical framework that reformulates the hylomorphic theory in light of recent scientific discoveries. Espe- cially significant and probably most controversial is the proposal to combine the plant/animal categories associated with classical hylomorphism. The human soul and every other kind of soul would be understood here, not according to their generic powers, but by their capacities to organize the molecular network that drives species- specific development. It is a proposal that enhances the explanatory power of hylo- morphic theory without sacrificing its basic principles, which affirm the substantiality of living organisms that are able to change and yet remain the same. Not insignifi- cantly, systems hylomorphism also justifies the theory of immediate hominization that embraces the fully personal status of the very early stage human embryo.

This matter appears to me to be interestingly set forth in a paper by Joachim Huarte and Antoine Suarez:[4]

By way of comparison, the human body after brain death behaves in much the same way as before brain death with regard to certain basic functions of life, such as heart-beating and blood circulation. The basic functions found in a brain dead hu- man are actually greater than those found in a parthenote produced through the pro-

[4] J. Huarte, A. Suarez, *On the Status of Parthenotes Defining the Developmental Potentiality of the Human Embryo*, in "National Catholic Bioethics Quarterly," Winter 2004.

cedure described above. If one holds that a brain dead human is not a person, then one can also hold that a parthenote, ...is not a person. If one rejects the use of such parthenotes as sources of stem cells, then one should also reject the use of brain dead humans as sources of organs.

III.

There is, as is well known, a long and historical discussion in Catholic moral theological circles about the formation of a practically certain conscience, and this comes into play particularly when the lawfulness of an action is in doubt. Without going into a long disposition about this particular matter, suffice it to say that there is a rejection of those kinds of moral systems which are called absolute tutiorism, mitigated tutiorism, probabilior-ism, aequi-probabiliorism, compensationism, and laxism. What is acceptable in Catholic moral theological circles is what is called probabilism. This is the system according to which one may follow the opinion that favors liberty as long as he is certain that that opinion is well founded, even though a contrary opinion might be more probable. I want it to be clear that I am not questioning probabilism, nor the use of probabilism in my remarks about the doubt of fact involved in unpaired vital organ transplantation.
To quote the moral theologian, Reverend Heribert Jone, O.F.M.Cap.:

If there is a question of the necessary attainment of an end, one must choose what is more certain if one cannot dispel the theoretical doubt. If eternal salvation is at stake, one must use those means which will certainly lead to that end. As long as cer- tain means are available, one may not employ means that are only probably suffi- cient. In administering the sacraments, for instance, one must, out of reverence due to the sacrament, and often out of justice and charity, decide in favor of the opinion that safe-guards the validity of the sacrament. If one cannot have certainly valid mat- ter for the administration of the sacrament, he may, in that case, for the sake of a soul's salvation, use doubtful matter. If there is a question of the certain right of an- other or of an injury threatening him, we must follow that opinion according to which the other will certainly obtain justice or be protected from harm. Thus, a physician may not use remedies whose effectiveness is doubtful if certain effective remedies are available. A hunter may not shoot when he reasonably doubts whether he will injure a man by doing so.
It seems to me that this moral principle which is enunciated in all Catholic moral theology manuals, as it has been for many centuries, deserves the ut-

most consideration when one looks at, not in the first place the possible re- cipient of an unpaired organ transplant, but the donor of the same. As far as I know, no respectable, learned and accepted moral Catholic theologian has said that the words of Jesus regarding laying down one's life for one's friends (John 15:13) is a command or even a license for suicidal consent for the ben- efit of another's continuation of earthly life. Even if the donor of an unpaired vital organ, such as a heart or a liver, has previously consented to its being do- nated, (this is not a most likely scenario since it is usually the members of a patient's family who give this kind of consent) it is, in my view, highly ques- tionable whether there exists such a right to make such a donation before the actual ascertainment of death. Much less does it seem to be a legal and moral prerogative for others to make such organ donations prior to the moral cer- tainty of true theological death which is to say the definitive separation of a person's body from his or her soul.

IV.

It is a common moral teaching from the very beginning of the Catholic Church's existence, that deliberate homicide is a grievous mortal and spiri- tually lethal sin. It is also[5] and has been for an extended period of time, an ecclesiastical crime, called a delict against human life and freedom. In the common estimation of humanity, to cut the beating heart out of a breathing person who is ingesting food, excreting waste, and responding to external stimuli, such as jabs and pokes by needles and knives, is considered an act of homicide. This is somewhat corroborated by a recent civil criminal case brought in the State of Colorado at the end of the past year, regarding an or- gan transplant operation from someone who was determined in civil law to be actually alive. The question that arises then is, how does one present to a moral theologian who is a consultant or, for that matter, to a confessor, in an apodictic way, moral certitude about the death of a person who is called 'brain dead' in whom necrosis has by some means or another been deter- mined to have overtaken the cerebrum, the cerebellum, and the brain stem, but not the rest of the organism?

There are some additional questions that a non-empirical scientist would want to bring to the table when discussing the issue of 'brain death'. One of

[5] Confer Canon 1397, Code of Canon Law, 1983.

the first that occurs to me is: What are the means by which ‘brain death’, if such a thing exists, can be determined? In some of the civil jurisdiction cas- es in the United States, ‘brain death’ is not determined by machinery or any- thing of the sort, but by the pronouncement of a neurologist, who, in some jurisdictions need not do much more than simply take the word of an at- tending cardiologist or physician, or even a cardiologist eagerly awaiting a heart for transplantation.

Also, in that same line, a question arises as to whether there is any kind of machinery, apart from a cranial dissection, that can determine whether there is any activity in the interior of the brain in an unconscious patient. It is my understanding that at the present time, those technologies (e.g., EEG), which can look into the possibility of brain activity generally are able to de- termine electrical activity only in the outer one to two centimeters of the brain, rather than in the deep, interior aspects of the brain. Do we have then, moral certitude in any way that can be called apodictic regarding even the ex- istence, much less the cessation of brain activity?

The second question that I could raise regards the nature of the paralyz- ing agents that are almost universally injected into donors of non-paired or- gans, before the actual excisions of those organs prior to their transplanta- tion into the recipient. I have been told, in such a way as it is difficult to dis- believe, that normally patients who are donating a heart, for example, would wince and squirm as the incision and the sawing open of the sternum occurs, and it is to prevent this response to the intrusion of the surgical instruments, that the donor is paralyzed with some chemical substances. This also, as I un- derstand it, is to allay the possible squeamishness of attendant medical per- sonnel who are participating in or witnessing the event. It is said as well that immediately prior to the excision of a heart from a transplant donor, the heart itself is stopped by the transplant surgeon. This, too, would raise serious questions as to how and to what extent this might fall under the definition of the sin, crime and delict of homicide.

Third, as I understand it, unless respiration and circulation continue, sin- gle unpaired organs that would be donated would not be of use; that is, after clinical death was declared on the basis of cessation of circulation and respi- ration, unpaired vital organs are not suitable for transplantation.

Thus, while human motivations are rarely pure and unalloyed, but almost always mixed in some measure, one has to wonder whether or not the pres- sure from those who are concerned (most likely in deep charity and human compassion) for people in need of new organs from other human beings in

order to survive and continue their lives on this earth, might not bring a cer- tain lack of objectivity into the study of the issue, and particularly whether or not a relatively unemotional and detached discourse regarding 'brain death' (if any such thing exists) and its relationship to death, understood in a Catholic theological sense might be unduly colored and slanted in a less than clear perspective.

Fourth, ecclesiastical authorities have not hesitated to speak clearly about a certain lack of rights in regard to some moral issues. What comes to mind, of course, are in vitro fertilizations, gamete transfer techniques, and similar undertakings that have been clearly taught as immoral, married couples hav- ing been told very clearly that there is no intrinsic right to have children. Sim- ilarly, it may be necessary to determine from a moral as well as canonical point of view whether there is a 'right' to have donated organs from other human beings inserted into one's body, even to save one's life or to prolong one's life. This lack of a right would have special meaning, of course, if what is being donated means in any traditional or conservative way causing the death of the one donating the needed body part.

In order to contextualize my remarks and to present them against the background from which I come, it might be appropriate briefly to outline the Catholic defense of life from conception to natural end. In no way is this sum- mary a complete understanding or complete presentation of the issue which is vast and complex. Rather it does provide, I believe, a viewpoint that may be valuable for a person to consider perhaps, from another point of view than that which may have been previously held about the whole issue of 'brain death'.

The long continuity of the historic tradition of the Catholic Church in re- gard to life-morality issues needs little explanation for anyone who has a rea- sonably comprehensive view of the last 2000 years of history, particularly Eu- ropean and American history. That the teaching of the Catholic Church, both to those who were and are her members, as well as the teaching of the Catholic Church in regard to the natural moral law, binding on all of hu- manity is with some measure of historical development, rather constant and unvaried, over twenty-one centuries in recent recorded history. The continu- ity and consistency of the principles on which Catholic teaching in the mat- ter are based, despite growing human technological abilities and scientific discoveries, and the growth of empirical, scientific knowledge can be said to have reached a sort of apex and climax in the encyclical letter *Evangelium Vi- tae*, (*The Gospel of Life*) issued by Pope John Paul II on March 25, 1995.

In that encyclical, the Holy Father states apodictically that "human life is always a good. This is an instinctive perception and a fact of experience, and man is called to grasp the profound reason why this is so." As the Pope claimed in his encyclical *Fides et Ratio,* (*Faith and Reason*) both human reason as well as faith are the wings which enable us to soar into the realm of truth. And so, the Catholic doctrine of life and the necessity to defend life derives in part from the use of human reason, even when it is unaided by divine revelation. At the same time, it is also found, and most profoundly so, in the revelation of the Almighty. Unaided human reason certainly indicates that the human species and individual human beings are unique in the spectrum of living creatures. As "rational animals," human beings enjoy the power of intellect, given the ca- pacity, (at least, in every human being, the potential capacity) for abstract thought and intellectual and rational accomplishment. *Homo sapiens* rises far above other forms of life, no matter how understanding one might be in their regard. Even were one to concede that life itself is a result rather than a cause, one still would have to grant the particularity of human beings. In addition to the intellect, human beings have a free will. When cranial and appropriate cer- vical development have taken place, with this volition they have the ability to stand against instinct and all the various kinds of chemical and hormonal propensities which seem to reside in most forms of life. Human beings, it ap- pears, are alone in the spectrum of creatures as possessing the capacity to un- derstand impending mortality and who alone have the capacity it seems also to have a moral perspective, especially being able to understand certain things as good, and certain things as bad, and allowing this perspective to influence to some extent the volitional action of the human person. Of all living creatures, it appears that the human species alone enjoys the capacity, and sometimes the exercise of the capacity, to protect other species, and to assure, not only the sur- vival of the human species, but the survival by means of environmental and sim- ilar concerns other species which share the planet earth.

All of this, has led to the philosophical conclusion even apart from the bi- ological, anatomical, and physiological particularities of the human person, that a vital and indeed interior component of a human being is a spiritual, that is non-material element, which traditionally has gone by the name of the *soul*. Philosophically, therefore, the Catholic Church has always rejected ab- solute materialism and determinism as incompatible with the correct use of human reason.

It would be incorrect, however, to suppose that Catholic teaching, deriv- ing from the unaided use of human reason, is or was uninfluenced by the oth-

er aspect of approaching truth, which is to say, divine revelation. It is partic- ularly from the perspective of divine revelation that Catholic teaching takes on its full force, and the total dimension of what this teaching is and what the defense of life, deriving from that teaching should be. It is divine revelation which Pope John Paul II says gives a powerful and amazing answer to the question why life is good. Because from divine revelation, especially the poetic and ancient account of human creation in the Book of Genesis, the first book of the Bible, the unique character of human creation is emphasized. One would also want to reiterate what the Pope said in his encyclical that is quoting Saint Iraneaus of Lyons emphasizing, "Man, living man is the glory of God." The Pope goes on to say that man has been given a sublime dignity based on the intimate bond that unites him to his Creator, and in man there shines forth a reflection of God Himself. Life then, says the Pope, deriving from divine revelation "is a gift by which God shares something of Himself with His creatures."

In going on then to the specific Christian view of the reality of human life being of such a special value that it deserves the utmost attention and most vigorous defense, the Pope notes that this life of the human species is shared by the marvel of the Incarnation of God Himself. In reiterating this matter, the Pope also talks about natural human life being the basis and foundation on which a participation in the eternal life of God is made available to human beings. He quotes the Apostle John, (1 John 3:1-2) "See what love the Father has given us that we should be called children of God, and so we are. Beloved, we are God's children now. It does not yet appear what we shall be, but we know when He appears we shall be like Him for we shall see Him as He is." The Bishop of Rome then goes on to say:

Here the Christian truth about life becomes most sublime. The dignity of this life is linked, not only to its beginning, to the fact that it comes from God, but also to its final end to its destiny of fellowship with God in knowledge and love of Him. In the light of this truth, Saint Iranaeus qualifies and completes his praise of man, "the glory of God is indeed, man, living man," but the life of man consists in the vi- sion of God. The immediate consequences of this arise from this for human life in its earthly state, in which for that matter, eternal life already springs forth and begins to grow. Although man instinctively loves life because it is a good, this love will find further inspiration and strength in new breadth and depth in the divine dimensions of the good. Similarly, the love which every human being has for life cannot be re- duced simply to the desire to have sufficient space for self-expression, and for en- tering into relationships with others, rather it develops into a joyous awareness that

life can become the place where God manifests Himself, where we meet Him and enter into communion with Him. The life which Jesus gives in no way lessens the value of our existence in time. It takes it and directs it to its final destiny. Jesus is quoted as saying in the Gospel according to Saint John (11:25-26), "I am the Resur- rection and the Life. Whoever lives and believes in Me shall never die."

The teaching of the Catholic Church, of course, also involves a certain sacredness for the antecedents to human life, naturally, the living cells that constitute the gametes which have the potential to form the human zygote and the appropriate use of these living cells, have a moral dimension. However, that dimension is less important, important though it may be, than the dimension of life itself, which is to say, once conception takes place and the human zygote is formed, the zygote-blastocyst-embryo is human and has a particular and unique human dimension. Neither science nor divine revelation would give even the slightest hint to that zygote-blastocyst-embryo being anything less or than other than a human being. One could, I suppose argue about the capacity for identical twinning, which in some instances exists after the one cell stage, but the argument as far as the human dignity which is deserved is fundamentally as specious as those arguments that evolved in later stages, especially in medieval times about moments of 'quickening' and 'ensoulment', arguments based largely on faulty biology and defective knowledge of human physiological realities. The dignity and autonomy of a human being whether zygote, blastocyst, embryo, fetus, newborn, infant, adolescent, adult, disabled or handicapped adult, aged adult, adult in a comatose or (so-called) persistent vegetative state, etc. are viewed, as they have been viewed throughout the history of the Catholic Church as worthy of respect and entitled to protection from untoward human inter- vention effecting the termination of human life at any of those stages. The unjust taking of an innocent human life has always been proclaimed for 2000 years and, of course, in the Judaic foundation of Christianity for an even longer time, as profoundly and deeply immoral. This can explain to some extent the intense opposition of the Catholic Church because of her religious principles to such activities as abortion, euthanasia, cloning, embryonic stem-cell research, in vitro fertilization and other gamete transfer techniques.
In speaking about an error which he characterizes as scientism, Pope John Paul II, in the encyclical *Faith and Reason* has mentioned the temptation in modern times to adopt a principle that "whatever is possible, is there-

fore, moral." Upon reflection, even from those who do not accept what divine revelation tells humanity about its origins and destiny, one can certainly by some philosophical effort refute such an assertion.

The reality of human death which involves the separation of the human soul or life-principle from the physical and material component of a human being, is that which, in the Catholic perspective, can only be decided by the Creator and it is always in an arrogant affront to the prerogative of God to enter in a prideful way into a decision that He wills to reserve to Himself, although He does allow, because of human freedom, a freedom flawed by the primeval catastrophe that happened at the beginning of the human race, the possibility of His positive will being thwarted by the misuse of that freedom. As Pope John Paul II observes:

The Church knows well that it is difficult to mount an effective legal defense of life in pluralistic democracies because of the presence of strong, cultural currents with differing outlooks. At the same time, certain that moral truth cannot fail to make its presence deeply felt in every conscience, the Church encourages political leaders, starting with those who are Christians, not to give in, but to make those choices which, taking into account what is realistically attainable, will lead to a re- establishment of just order in the defense and promotion of the value of life.

The Pope also quotes the Second Vatican Ecumenical Council, which stated quite clearly that in all of these issues when the Creator is neglected, the creature becomes unintelligible. He notes: "The Gospel of life is not for believers alone, it is for everyone. The issue of life in its defense and promotion is not a concern of Christians alone. Although faith provides special light and strength, this question arises in every human conscience which seeks the truth and which cares about the future of humanity." Life certainly has a sacred and religious value, but in no way is that value only a concern of believers. The value at stake is one that every human being can grasp by the light of reason. Thus, it necessarily concerns everyone. Furthermore, it should be observed, as the Pope mentions, that "there can be no true democracy without a recognition of every person's dignity and without respect for his or her rights, nor can there be true peace unless life is defended and promoted." As Pope Paul VI pointed out: "Every crime against life is an attack on peace, especially if it strikes at the moral conduct of people. But where human rights are truly professed and publicly recognized and defended, peace becomes the joyful and operative climate of life in society."

The Holy Father also observes that it is impossible to further the common good without acknowledging and defending the right to life upon which all the other inalienable rights of individuals are founded and from which they develop. A society lacks solid foundations when on the one hand it asserts values, such as the dignity of the person, justice and peace, but then on the other hand, radically acts to the contrary by allowing or tolerating a variety of ways in which human life is devalued and violated, especially where it is weak or marginalized. Only respect for life can be the foundation and guarantee of the most precious and essential goods of society, such as democracy and peace.

Appendix
Anointing and Absolution after 'Apparent Death'

Thomas Slater, S.J., *A Manual of Moral Theology for English-Speaking Countries,* vol. II, Benziger, 1925, p. 71: "The sacraments were instituted to sanctify the souls of men and thus to prepare them for heaven. Only living men, then, can validly re- ceive the sacraments; dead men or other beings cannot receive them validly. Death takes place when the soul is separated from the body, but we do not know the pre- cise moment when that separation takes place. Except putrefaction, there are no ab- solutely certain signs of death, and it is quite probable that the soul remains united to the body for some time after all apparent signs of life have disappeared. Under these circumstances recent medical men and divines hold that it is lawful to admin- ister the last sacraments to one who has to all appearances been dead for an hour or two. This is especially the case when death is the result of some sudden accident."

Stanislaus Woywod, OFM, *A Practical Commentary on the Code of Canon Law, Vol.1*, Joseph F. Wagner, 1929, p. 480: "Doubt as to actual death may arise in those cases where the priest arrives shortly after the sick person has ceased to give any signs of life. The moment when the separation of the soul from the body takes place, is known to nobody, but it is generally held that some time intervenes between the last apparent signs of life and the actual separation of the soul from the body. In cases of previous illness and gradual weakening of the vitality, it is generally believed that the space of time between apparent death and actual dissolution is very short. In cases of sudden collapse in accidents, strokes of apoplexy, and the like, some writers hold that even two hours after the last signs of life Extreme Unction may be given condi- tionally. The Roman Ritual directs that in doubt as to the death of a person, the priest shall express the conditional anointing by the words: '*Si vivis, per istam sanctam Unc- tionem*, etc.' "

Henry Davis, S.J. *Moral and Pastoral Theology: A Summary*, Sheed and Ward, 1952; p. 290: "Since dying is, in the case of lingering sickness, a very slow process, a priest need not hesitate to absolve, give Extreme Unction, and the Last Blessing, to those who have been apparently dead for many hours, even until putrefaction be- comes visible"; p. 368 "When the Sacrament [Extreme Unction] is given condi- tionally in doubt about the subject being still alive, the ritual prescribes the condi- tion, '*si vivis*'. No other condition need ever be expressed. Since no one knows when death supervenes in cases of lingering sickness, after apparent death, or in sudden apparent death not due to serious accident, Extreme Unction may be given hours af- ter apparent death until putrefaction has set in."

Dominic M. Prummer, O.P., *Handbook of Moral Theology*, P.J. Kennedy & Sons, 1957; p. 377: "Extreme Unction must be administered conditionally in four cases: when there is doubt *a*) whether the invalid has attained the use of reason; *b*) whether the danger of death is really present; *c*) whether the person is dead; *d*) whether the person stubbornly perseveres in mortal sin without repentance. (c. 941 sq)"; p. 378 "Note: Extreme Unction should not be delayed until there is extreme danger of death but should be administered as soon as possible in a dangerous illness. Since it is not certain when the soul actually departs from the body the sacrament may be ad- ministered conditionally up to half an hour after apparent death."

John A. McHugh, O.P. and Charles J. Callan, O.P., *Moral Theology, A Complete Course*, Joseph F. Wagner, Inc., 1958; p. 740: "If the person has been pronounced dead before the priest's arrival, he should nevertheless be absolved and anointed conditionally if the last breath was not long before; because physicians teach that death takes possession gradually, life lingering in the body for some time after its ex- ternal signs have ceased, for about a half hour when the end has come after long ill- ness, for one or two hours when death is sudden or accidental."

Dom Gregory Manise, O.S.B., in Francesco Cardinal Roberti and Msgr. Pietro Palazzini, *Dictionary of Moral Theology*, Newman Press, 1957 (Italian), English trans- lation 1962; p. 495: "Needless to say, extreme unction cannot be administered to those already dead. Since, however, one cannot exclude the possibility of a state of latent life, which in certain cases lasts for some time after the heart and breathing have ceased, the Church, as a loving mother, permits within a short time (1/2 hour) after death the conditional administration of extreme unction to those who appear dead, and for a longer time (2 or 3 hours) after sudden death. In such cases, there should be no delay in summoning a priest, especially if the person still shows some sign of life."

Nicholas Halligan, O.P., *The Administration of the Sacraments*, Alba, 1963; p. 350ff. "Extreme Unction cannot be given to one who is certainly dead. However, in

a particular case *death* may be only *apparent* and not real, the only certain signs of the latter being rigor mortis and putrefaction. In the absence of these signs which lend certitude, the period between the apparent death and the actual cessation of all vital functions cannot be determined beyond reasonable doubt. In all cases of ap- parent death a single conditional anointing suffices: *si vivis*, a condition which the Roman Ritual requires to be expressed verbally (for lawfulness).

> a) In cases of sudden death, such as from epilepsy, apoplexy, suffocation, drowning, electrocution, and similar violent deaths, it is likely that life lingers for some time after the apparent death of the person. Thus, in these circumstances a person may be anointed conditionally within an hour after apparent death, and even within two or three hours, especially if the person was in full vigor at the time of his demise. (In practice one may conditionally anoint the head of the decapitated). In order to avoid scandal or laxity in summoning a priest, it may be expedient to explain to the bvs- tanders that the actual moment of death is uncertain and that the sacraments are for men.
>
> b) Where lingering illness has gradually consumed the person, it is considered that real death occurs shortly after all signs of life have ceased. Extreme Unction may thus be conferred within a half-hour of apparent death."

Germain Grisez, *The Way of the Lord Jesus, Volume One: Christian Moral Prin- ciples*, Franciscan Herald Press, 1983; p. 781: "Likewise, a dying and unconscious adult, if not certainly dead, should be anointed if there is any ground to believe that he or she would have desired to receive the sacraments. In all doubtful cases, in- cluding persons apparently but not certainly dead, the sacrament is administered conditionally." Code of Canon Law (1983) c. 1005 "This sacrament [anointing] is to be administered when there is a doubt whether the sick person has attained the use of reason, whether the person is dangerously ill, or whether the person is dead."

Nicholas Halligan, O.P., *The Sacraments and their Celebration*, Alba House, 1986; p. 127: "If a priest is called to a sick person who has already died, he should offer prayers to God that the might be absolved from his sins and admitted by the divine clemency into the heavenly kingdom. He is not to anoint him. If he doubts whether the person is truly dead, he may confer the sacrament."

Rev. Adrian Jerome Kilker, JCD, *Extreme Unction: A Canonical Treatise*, Herder, 1927; p. 210-223.8

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Death: the absence of life[**]

PAUL A. BYRNE

I. Preamble

The human person has a definition, "an individual substance of a nature that is rational." Manlius Severinus Boethius defined the person: "*naturae rationalis individua substantia.*" The ancient Hippocratic Oath stated "Aid, heal, do no harm, do not kill." Medical Ethics in philosophy states the Oath in principles related to life. Bioethics applies the principles of the Science of Ethics to protect and preserve life and postpone death.
There is an error that man is an end to himself, and the sole maker with supreme control of his own history (*propriae suae historae solus artifex et demiurgus*).[58] The result of this error includes 'brain death'.
The Instruction on Bioethics from the Congregation for the Doctrine of the Faith provides direction in these serious moral matters. "For it is only in keeping with his true nature that the human person can achieve self-realization as a 'unified totality'."[59] By virtue of its substantial union with a spiritual soul, the human body cannot be considered as a mere complex of tissues, organs and functions, nor can it be evaluated in the same way as the body of animals [beasts, brutes]; rather it is a constitutive part of the person, who manifests and expresses himself through it.

The natural moral law expresses and lays down the purposes, rights and duties which are based upon the bodily and spiritual nature of the human person. Therefore this law cannot be thought of as simply a set of norms on the biological level; rather it must be defined as the rational order whereby man is called by the Creator to direct and regulate his life and actions and in particular to make use of his own body.[60]

The whole of section 3 of the *Introduction* explains the definition of bioethics. Even though the concentration is on the *Dignity of Procreation,* the explanation of bioethics is an authentic portrayal of the natural moral law related to life.
The study of the natural moral law and bioethics, as explained in philosophy, offers right principles for practice. Modern so-called 'bioethics' consider persons as chattel, e.g., to supply organs for transplantation. A significant issue in organ donation is whether the donor is dead or alive. Before death, a person out of love and charity may donate organs not necessary for continued life and health, i.e., under usual circumstances, one of two kidneys, one lobe of the liver, one lobe of one lung, blood, and bone marrow. At the time of donation precautions must be taken to preserve and protect the life and health of the donor. Informed consent of the person donating the organ and benefit to the life or health of the person receiving the transplant are required.

[**] Presented at the Conference on the "Signs of Death", The Pontifical Academy of Sciences, Vatican City, February 3-4, 2005.
[58] Concilium Vaticanum II, *Gaudium et Spes*, Part I, Ch. I, § 20.
[59] Congregation for the Doctrine of the Faith, *Donum Vitae*, § 3 (quoting John Paul II, *Familiaris Consortio,* § 11, in "Acta Apostolicae Sedis", 74, 1982, p. 92).
[60] Congregation for the Doctrine of the Faith, *Donum Vitae*, § 3, in "Acta Apostolicae Sedis", 80, 1988, pp. 70-102.

Organs at normal body temperature vary as to how long they can withstand absence of circulation and respiration until damage is severe enough to make them unsuitable for transplantation. Without circulation, the heart and liver are damaged in about 3-5 minutes; kidneys, in about 30 minutes. For organs to be useful for transplantation, circulation and respiration are required until a short time before removal of the organs. Thus, it is a beating heart that is stopped by the transplant surgeon just before the excised heart is lifted from the chest for transplantation.

II. Introduction

There has always been the haunting possibility of a premature declaration of death. Therefore the goal of medical practice used to be that a living person would not be declared dead. Until the advent of mechanical ventilators and other complex life supporting therapies, the mistake of judging a dead person as alive was practically impossible. Prior to these developments and the desire to do vital organ transplantation, medicine made every effort to judge the moment of death in the direction of preserving human life from a death-dealing mistake.

'Brain death' has almost as many definitions as there are people who have used these two words. Some differences and difficulties were published twenty- five years ago.[61] Many believe that when someone's brain is so damaged and functioning cannot be in accord with their definition of a normal living person and it seems recovery will not occur, the person is dead, or as good as dead. Upon a declaration of 'brain death', it is often expressed that treatment can be stopped and let "nature take its course." Little do they realize that a declaration of 'brain death' is not followed by stopping treatment; rather treatment is continued, often consisting of improved and superior quality, until it is more convenient to excise vital organs. After excision, then the patient is truly dead!

In 1975 I was treating and caring for an infant in the Neonatal Intensive Care Nursery at Cardinal Glennon Memorial Hospital for Children in St. Louis Missouri. Joseph had been on a ventilator for six weeks. Many attempts were made to wean him from the ventilator. He would not breathe spontaneously. A recording of electrical activity (EEG) was done. It was interpreted as "consistent with cerebral death." Two days later the EEG was unchanged. It was suggested to take him off the ventilator. Nevertheless, I continued to treat him with the ventilator. Later he was able to be weaned from the ventilator and eventually able to be discharged from the hospital. He grew and developed normally; he went to school; his grades were excellent; he ran track and played baseball. As an adult he has been working as a paramedic for ten years and currently is a fireman in St. Louis, Missouri. He is now almost 30 years of age.

Joseph was the index case that stimulated my interest in 'brain death'. Even though at that time I was informed that 'brain death' criteria for infants and children less than five years of age did not exist, I began by reviewing articles from the literature on the general topic of 'brain death'.

[61] P.A. Byrne, S. O'Reilly, P.M. Quay, *Brain Death - An Opposing View Point,* in "Journal of the American Medical Association", 242, 1979, pp. 1985-1990.

III. Life of the Person on Earth

Many have observed over the past 35 years the reality of the differences between life, 'brain death' and true death. Confusion and blurring of definitions has occurred because of looking away from precise definitions, and decreased, or lack of, respect for life of a person. Life is the substantial fact of the unity of the soul and the body. The soul contains the body. The soul is whole and entire in the whole body and entire in each part of the body. Life manifests the soul- body presence in the living person. There is interdependence of organs and systems to maintain the unity of the body of the person. Each person is special, unique and unrepeatable.

Life of the human person is the important consideration. Life is in all organs, tissues and cells of the body. Only a living person can be a patient for a physician. Treatments, medications, procedure and operations can be effective only in a living patient. For example, a pacemaker can initiate a heartbeat only when the patient is living; a ventilator can result in respiration only when the patient is living. Exchange of oxygen and carbon dioxide supported by a ventilator indicates the patient is living. After true death, i.e., separation of the soul from the body, the pacemaker sends a signal but it cannot initiate a heartbeat. Likewise, after separation of the soul from the body the ventilator can move air but there is no respiration. The life of the person is a reality. Life of the person on earth biologically is composed of cells, tissues, organs and eleven systems, including three major vital systems. There is interdependent functioning of organs and systems to maintain homeostasis, immune defenses, growth, healing, unity and exchange with environment, e.g., oxygen and carbon dioxide. No one organ or system controls all other organs and systems. Vital signs of temperature, pulse, blood pressure and respiration are manifestations of vital functions necessary for life on earth.

Life of the person is of the greatest significance because each person is made in the Image and Likeness of God. Life on earth is a continuum from its conception until its natural end. Pope John Paul II reminded us again on February 4, 2003 in his written comments at the World Day of the Sick: "It remains a fundamental precept that life is to be protected and defended from its conception to its natural end … [E]very transplant must take into account … [that] it is never licit to kill one human being to save another."[62]

When any patient is ill or injured, the physician has the privilege of treating and caring for the sick person. The standard of the relationship between the physician and the patient (sick person) is one of intrinsic worth. The physician can protect and preserve life and postpone death. Anything else cannot be included as medical diagnoses, treatments or care.

When a patient has an injury or disease of the brain that requires treatment with a ventilator (commonly also called a respirator, but not accurately so), the ventilator moves air, oxygen and carbon dioxide. The actual exchange of

[62] John Paul II, *Message for 11th World Day of the Sick*, Washington, DC., February 11, 2003 (http://www.vatican.va/holy_father/john_paul_ii/messages/sick/documents/hf_jp-ii_mes_20030207_world-day-of-the-sick-2003_en.html).

oxygen and carbon dioxide is intrinsic to the respiratory system. Circulation is intrinsic to the heart and circulatory system. For life of the person to be supported by the ventilator, many other organs and systems must be intact and normally functioning, including liver and kidneys. The physician has the privilege to diagnose, treat and care for such a patient. The physician must not kill, must not do harm and must not hasten death.

Healing occurs only in the living. As soon as there is exogenous or endogenous injury to a tissue, a complex healing reaction called inflammation occurs in the vascularized connective tissue. This healing begins immediately at the site of the injury but circulation is needed to bring necessary defense and healing components from distant tissues and organs to the site of injury. Neutrophils, eosinophils, lymphocytes, basophils and platelets are required. Hormones produced as part of the endocrine system are brought to the site of injury by the circulatory system. The breakdown products of the injury are picked up and carried by the circulation to the liver, spleen and kidneys for detoxification and excretion. Inflammation is followed by regeneration. Healing can occur only in the living with an intact and functioning circulatory system. No healing can occur after true death. Healing is apparent in patients after the declaration of 'brain death', but before vital organ excision. For example, if a cut were made through the skin into the subcutaneous tissues of a 'brain dead' patient prior to excision of vital organs, bleeding from the wound would occur and healing would begin immediately because the patient is not truly dead. If he were truly dead and a cut were made through the skin into the subcutaneous tissues, there would be oozing of fluid but no active bleeding. The healing processes would never occur because there would be no circulation to bring the healing white blood cells and hormones to the site of injury and no way to carry away the wastes for detoxification and excretion. There are no living cells to unite the tissues back together. Healing does occur in those declared 'brain dead', but never after true death.

IV. Death

Death is a negative; death is the absence of life. Death is the separation of the soul from the body. Death is the state of the body without life. After death the body is empty. After death what is left on earth is a corpse; the remains. In the remains dissolution, destruction, disintegration, and putrefaction occur and continue to the basic elements. Cooling, embalming and/or mummifying can slow them, but after death they do not stop.
Dead can be observed as cold, stiff and unresponsive to all stimuli. The corpse is not breathing; there is apnea; ventilation will not restore respiration. There is no heartbeat, pulse or blood pressure; there is poor color of the skin, nails and mucous membranes; there is no moving; there is absence of vital body functioning.

When biologically dead, homeostasis cannot be maintained. There is no growth, not even of hair and nails as rumored in the past. In reality after true death apparent growth of hair and nails is due to dehydration and shrinkage of surrounding tissues.
After true death the unity of body and soul is no longer. There is destruction, disintegration and dissolution of cells, tissues, organs and vital systems. The relationship to the environment is no longer one of exchange. After true death the dead body disintegrates ultimately into the basic elements. This disintegration goes on and on, although cooling, embalming and mummification can slow it.
The declaration of death ought to be identified as a negative; an absence of life. A person ought not be declared dead unless a basic minimum is present. In an organism as complicated as the human person the basic minimum ought to include destruction of the three major vital systems: the circulatory and respiratory systems and the entire brain. Thus, no one ought to be declared dead unless there is destruction of at least these three major vital systems. This ought to be done in accord with generally accepted standards.

V. Origination and Development of 'Brain Death'

Historically, before 1968, after death, organs were not suitable for transplantation. Hence, because of interest in organ transplantation, a different way of declaring someone dead developed. Now, organ transplanters are taking living, healthy organs, e.g., heart, lungs, kidneys, pancreas and intestines from those who have been declared 'brain dead'. Although it is done under the guise of legality, the medical and moral issue is: "Are the donors truly dead before excision of organs?"
'Brain death' did not originate or develop by way of application of the scientific method. (Some of the following was published in *Brain Death Is Not Death.*).[63] 'Brain death' began with the appointment of the Harvard Committee to consider the issues. The results of their work were in the *Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death.*[64] The first words of this report are as follows: "Our primary purpose is to define irreversible coma as a new criterion for death." Was this the hubris of a few academicians or was it simply a surrender to fear of legal chastisement regarding perceived economic and utilitarian needs in 1968, especially the desire to get healthy living vital organs for transplantation? It seems that a predetermined agenda existed from the onset. There were no patient data and no references to basic scientific studies. In fact there was only one reference, which was to Pope Pius XII.[65] While there was a reference to and a quotation from this Allocution of Pope Pius XII, they neglected to include the following: "But considerations of a general nature allow us to believe that human life continues for as long as its vital functions – distinguished from the simple life of organs – manifest themselves spontaneously or even with the help of artificial processes."

[63] P.A. Byrne, W.F. Weaver, *Brain Death Is Not Death*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, New York, Kluwer Academic/Plenum Publishers, 2004, pp. 43-49.
[64] *A Definition of Death. Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death*, in "Journal of the American Medical Association", 205, 1968, pp. 337-340.
[65] Pius XII, *To an International Congress of Anesthesiologists, Nov. 24, 1957*, in *The Pope Speaks*, vol. 4, n. 4, 1958, pp. 393–398.

The primary purpose of the Committee was not to determine if irreversible coma was an appropriate criterion for death but to see to it that it was established as a "new criterion for death." With an agenda like that at the outset, the data could be made to fit into their already arrived at conclusions. There was a serious lack of scientific method in the origination that has continued to the present time in the development of 'brain death'.
'Brain death' is not true death. Rather it is observing cessation of functioning of the brain, which is then translated into 'brain death'. The primary reason for the origination and propagation of 'brain death' was and is the desire to obtain vital organs for transplantation. It can now be ascertained that a validly applied scientific method, sound reasoning, and available medical technology were not utilized in developing this *new* way of determination of death called 'brain death' for the simple reason that true death is the absence of life. Life and true death cannot and do not exist at the same time in the same person. Embalming and burial are actions proper to be done to a corpse. Embalming and burial after a declaration of 'brain death' before true death would not be acceptable to anyone.
After an injury to the brain, cessation of some brain functioning and reflexes can be observed. At this time the patient is on a ventilator with normal respiration, a beating heart and normal blood pressure. This is quite different from true death manifested by: no breathing, no heartbeat and no reflexes. Therefore, "brain death" is not simply an error; 'brain death' is false death.
The difference between error and false:
Error – aim at a bull's-eye on a target; miss it; you can correct the aim the next time.
False – look at the target, but shoot in the opposite direction; no amount of correction can be done to hit the target, except turn around and get on target.
Pope John Paul II once said: "Error makes its way because the truth is not taught."

VI. The Brain

"The brain consists not of a single part but of several closely interrelated ones (cortex, cerebellum, midbrain, medulla, etc.). Though composed of superficially similar tissues that are closely linked together both anatomical1y and physiologically, these parts can continue to have activity independently of one another, even when one or more of them have been destroyed. As one might then expect, the brain as a whole has no physiologically identifiable function or functions that could rightly be called the "life-giving function or functions." Rather, there exists a large multiplicity of different functions that are characteristic of the different parts. Although the characteristic functions of the brain-parts normally are closely coordinated, the parts have different functions that often cannot be carried out without the other parts. Further, none of these parts are in complete control of the others.

The brain is an organ whose varied functions serve to integrate by biophysical, biochemical, or other neuronal mechanisms the different parts of the body. Such physiological operations of integration are, in fact, the ordinary conditions for the continuance of the organismic unity of the body. The brain's ceasing to function does not imply, *a priori,* its destruction but only absence of physiological activity at the time of the evaluation. If the persistence of absence of physiologic activity is accompanied by asystole, hypotension, and other detrimental responses, then this leads quickly to destruction of the brain, theheart, and disintegration of the body called death. However, with immediate institution of life supporting measures, the brain tissue may end up being only stunned. Often at the time of the initial absence of physiological functioning, this will have caused the patient to be declared 'brain dead'. Even if another examiner consults (as required in some situations) an apnea test or variant of it[66] will likely further compromise recovery of brain tissue. By this time the treatment will have shifted from attempting to reduce further neurological damage to the donor to preservation of his healthy vital organs for the benefit of the recipient.

VII. The Apnea Test

It is important to acknowledge that a high percentage of those accepting "brain death" as true death, change their mind after they are exposed to the brutality of vital organ transplantation. For example:
EVERY SET OF CRITERIA FOR 'BRAIN DEATH' INCLUDES AN APNEA TEST. ('APNEA' MEANS THE ABSENCE OF BREATHING). THIS TEST, WHICH HAS NO BENEFIT FOR THE COMATOSE PATIENT AND, IN FACT, AGGRAVATES THE PATIENT'S ALREADY COMPROMISED CONDITION, IS DONE WITHOUT THE KNOWLEDGE
OR INFORMED CONSENT OF FAMILY MEMBERS. When a patient is on a life supporting ventilator to receive oxygen and get rid of carbon dioxide, turning off the ventilator to see if they can breathe on their own is the same as choking or strangulation of this living human being. The resulting accumulation of carbon dioxide in the body can cause further damage to already injured cells of the brain and even true death. An increase in carbon dioxide can cause the brain to swell which further decreases the already compromised circulation within the skull. When the brain, heart, lungs or other vital organs are in a damaged state, even small time periods of lack of breathing will further damage them. The apnea test, during which the ventilator is turned off for up to 10 minutes until the carbon dioxide goes to 60 or higher (normal is 35-45), can induce a decrease in blood pressure or cardiac arrest. The sole purpose of the apnea test is to determine the patient's ability/inability to breathe on his/her own in order to declare him/her 'brain dead'. It is illogical to perform a

[66] J.L. Goudreau, E.F.M. Wijdicks, S.F. Emery, *Complications during apnea testing in the determination of brain death: Predisposing factors*, in "Neurology", 55, 2000, pp. 1045-1048.

stressful, possibly lethal, apnea test on a patient who has just undergone severe head trauma. Turning off the ventilator for up to 10 minutes risks further damage and even killing a comatose patient, who might otherwise survive and resume spontaneous breathing if treated properly.

Most people are probably unaware that before the patient is declared 'brain dead', the transplant physician must perform this most cruel test on a patient who is already in a very delicate state. Without the apnea test, the diagnosis of 'brain death' is impossible, and without the diagnosis of 'brain death', the transplantation of unpaired vital organs is not permissible. Medical professionals in the transplant system refuse to acknowledge in public the detrimental effects of the apnea test. They also reject obtaining written consent to do the apnea test because, if the apnea test is explained in detail, no family member who loves the patient would authorize it.

VIII. Many Criteria: To Be or Not To Be 'Brain Dead'

'Brain death' is defined according to many disparate sets of criteria. No matter which set of criteria is used to legally declare 'brain death', the reality of true death occurs when vital organs are excised, or when life support is discontinued and the patient cannot breathe on his/her own. Even though further study was clearly called for, e.g., in the "Journal of the American Medical Association" when the data from the Collaborative Study was culled to develop yet another set of criteria, it was concluded, "these criteria were recommended for a larger clinical trial." Twenty-eight years later this has not occurred and probably will never occur since the authors themselves have not done it and no one else has held them responsible to their conclusions.

Every set of criteria requires the 'apnea test'. This test is done by taking the patient off the ventilator for up to ten minutes, which increase the pCO_2 to a very abnormal 60 or higher (normal is not higher than 45). This is done while observing the patient for evidence of spontaneous breathing. Increase in carbon dioxide can increase brain swelling. Thus, the 'apnea test' can increase brain pathology. This test cannot benefit the patient. If the patient does not demonstrate breathing after removal of the ventilator, this becomes the signal to cut out the beating heart.

The very diagnosis of 'brain death' militates against any further attempt to evaluate outcome of these different critical subsets of legally deceased patients, since their true physiologic death comes when they are utilized for vital organ donation, subjects for teaching or research, (permitted under the Uniform Anatomical Gift Act), or when life-support efforts are discontinued. All subsets

utilized life-supporting measures since their value as a live human is maintained in this manner and justified by being perceived as 'good'. Little interest or effort to study 'brain dead' patients has occurred to evaluate long- term response/recovery outcomes with present day life-supporting efforts.

IX. Was There Any Science?

Brain-related criteria are not based on valid scientific data. Much like the Harvard Criteria, without patient data and references to basic science reports, the Minnesota Criteria[67] evolved from a study of a small number of only 25 patients. Only nine had an EEG done and two of these had 'biologic' activity in their EEG after they had been declared 'brain dead'. Their unworthy conclusion: No longer is it necessary to do an EEG.

It is scientifically invalid not to use an EEG in the diagnosis of 'brain death' if any degree of certainty is to be obtained. The British Criteria do not include the EEG.[68] The British were considerably influenced by the Minnesota Criteria that do not require an EEG. The National Institutes of Health, although "recommended for a larger clinical trial," has never been done.[69]

By 1978, more than 30 sets of criteria had been published. Many more have subsequently appeared for various reasons and in different countries. In most cases, physicians are free to choose any one of these. Thus, a patient could be determined to be dead by one set, but not by another.

X. Malleable Criteria

No matter how seemingly rigid the criteria are, the ease with which they can be bent is manifested in the report by the President's Commission, where it is written: "An individual with irreversible cessation of all functions of the entire brain, including the brain stem, is dead. The 'functions of the entire brain' that are relevant to the diagnosis are those that are clinically ascertainable."[70] In one sentence, whatever stringency was there has been reduced to no more than what can be "clinically ascertainable." Thankfully, there is more physiology taking place in all of us than what is "clinically ascertainable."

If one uses the Minnesota Criteria, the British Criteria, or the published Guidelines of the President's Commission, it is not necessary to include EEG

[67] A. Mohandas, S.N. Chou, *Brain death. A clinical and pathological study*, in "Journal of Neurosurgery", 35, 2, 1971, pp. 211-218.

[68] Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagnosis of Brain Death*, in "British Medical Journal", 2, 1976, pp. 1187-1188.

[69] *An Appraisal of the Criteria of Cerebrale Death. A Summary Statement: A Collaborative Study*, in "Journal of the American Medical Association", 237, 1977, pp. 982-986.

[70] *Guidelines for the determination of death: report of the medical consultants on the diagnosis of death to the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research*, in "Journal of the American Medical Association", 246, 1981, pp. 2184-2186.

evaluation in determining 'brain death'. In which case, if the cortex is still functioning, but is wholly cut off from manifesting its activity clinically by damage elsewhere in the brain–something that does occur and which an EEG can clearly show–then this functioning (which could involve memory, feelings, emotion, language skills, etc.) is suddenly considered irrelevant to the person's life or death. According to the NIH Study, 8% of those declared dead on the basis of criteria that omit the EEG, still have cortical activity when evaluated by non-clinical means (EEG). Thus, action such as excision of a donor's beating heart causes death in *at least* one out of twelve cases under such circumstances. As Dr. Walker (Clinical Neurosciences, 1975)[71] wrote, this represents "an anomalous and undesirable situation." The general public might use much stronger words!

The activities of the cerebral cortex cannot be evaluated clinically in an unconscious person. The EEG gives a recording of electrical activity from the outer one to two centimeters of cortex. Cerebellar activity cannot be evaluated clinically or electrophysiologically in the unconscious patient. Thus no diagnostic criteria can observe and conclude absence of all cerebral and cerebellar activities by fact of clinical observation and evaluation.

A physician can choose any of the many disparate sets to declare a patient 'brain dead', yet the other sets would declare the same patient to be alive and not 'brain dead'. Information about these disparity ought to be required to better inform potential donors and potential recipients. Shouldn't all unpaired whole vital organ transplantations be questioned?

XI. 'Brain Dead', But Not Dead Yet!

'Brain dead' patients have spontaneous jerks of limbs and tone in their muscles. Some have been observed with their arms crossing their chest and sitting up. Grimacing and squirming occurs in response to surgical incisions without paralytic drugs or anesthesia. When a paralytic drug is administered without anesthesia, heart rate and blood pressure increase. During organ excision paralytic drugs are given to take away protests from those in the operating room. Patients declared 'brain dead' often retain salt and water balance. This is evidence of hypothalamic-pituitary functioning in patients who have been declared 'brain dead'.

'Brain dead' pregnant mothers, treated well with life-supporting efforts, have survived for many months until delivery of a normal child.[72] Nevertheless, when the patient is not pregnant and treated as a prospective donor, there often seems to be a utilitarian based urgency to declare 'brain death' and move ahead with vital organ transplantation. Transplant cardiologists know it is important to protect and preserve the vital organs during this urgency. But one must wonder:

[71] A.E. Walker, *Cerebral Death. 2 - The Nervous System: The Clinical Neurosciences 75*, Tower & Chase ed. 1975.

[72] I.M. Bernstein, M. Watson, G.M. Simmons, et al., *Maternal brain death and prolonged fetal survival*, in "Obstetrics & Gynaecology", 74, 3, 1989, pp. 434-437.

Could it be that it is also urgent to move ahead before any signs of *recovery of brain function* would appear and possibly cause embarrassment to the physician who had declared 'brain death'?
It is curious to note that in 'brain dead' victims of homicidal assault, rarely do lawyers file charges until the victim is truly and certainly dead. In similar manner, an undertaker would never embalm until 'brain dead' patients are truly and unequivocally dead. Life preserving research is rarely done in 'brain dead' patients, but of course it would have to be done prior to apnea testing. Why is common sense and reality being overruled by utilitarian reasoning?

XII. Cessation of Functioning, Function, Functions or Destruction

If there is an irreversible loss of all the characteristic functions of the brain, must we say that the brain has been wholly destroyed? 'Destroy' is used in its primary sense: "to break down or disintegrate the basic structure of," "to disrupt or obliterate the constitutive and ordered unity of." 'Destruction' does not imply abruptness or physical violence. For the brain, 'destruction' implies such damage to the neurons that they disintegrate physically, both individually and collectively. The converse, of course, is obvious: the total destruction of the entire brain does imply irreversible cessation of every kind of brain functioning, function and functions, but not loss of life (e.g., T.K. and others in Shewmon's meta-analysis).[73]
Many varieties of reversible cessation of brain functioning are known. Most of these are nondestructive. But there is no known medical principle that requires that a nondestructive cessation of functioning, function or functions must always be reversible. There is no evident contradiction in supposing the existence of permanent synaptic barriers, permanent analogs of botulinus toxin, or yet other mechanisms that would block all brain functioning while leaving the brain's neuronal structure intact and ready for action (at least until such time as the effects of this nonfunctioning on the rest of the body might react back on the brain in a destructive manner). Therefore, there is no reason to think that cessation of function, whether reversible or irreversible, necessarily implies total or even partial destruction of the brain; still less, death of the person.
Thus, the statutes that have sought to turn a loss of brain function into a general criterion of death are all nullified by a fundamental category mistake: they take *that which functions* to be simply identical with the act of functioning. Yet, if something irreversibly ceases to function, its existence is not necessarily extinguished thereby; it merely becomes permanently idle. Nonfunctioning, no matter what qualifiers are used with it, is not the same thing as destruction. The few existing pathological studies of brains in "brain dead" patients do not always confirm diffuse damage; in fact some specimens have been reported as showing only minor changes.[74]

[73] D.A. Shewmon *Chronic 'Brain Death': Meta-analysis and Conceptual Consequences*, in "Neurology", 51, 1998, pp. 1538-1545.
[74] *The NINCDS collaborative Study of Brain Death*, NINCDS Monograph No.24 - National Institute of Neurological and Communicative Disorders and Stroke, U.S. Department of Health and Human Services, NIH Publication No. 81-2286, December 1980.

In any case in which all functioning of the brain has irreversibly ceased, destruction of the brain and death will follow fairly quickly unless therapeutic action is taken. Hypothermia is an example of an approach to treatment that could be beneficial. If proper supportive action is administered, such an irreversible lack of brain function might last for a long time before the patient would begin to suffer destruction of brain tissue.
In such circumstances one would certainly not be free to treat a patient as dead. So long as we are dealing solely with cessation of functioning, function or functions we are dealing with a living patient. If, further, it is said that he is dying, by this very fact he is alive and not dead. Whatever room there may be for discussion, pro and con, concerning obligations to maintain the supportive action that prevents the situation from deteriorating, at least as long as destruction of the brain has not occurred, the patient is alive.[75] As far as we can now know, there would even remain some possibility that in some cases a successful therapy might be found, but at present there are no markers or studies by which these patients can be selected. This is the primary reason to study and evaluate these patients *scientifically*, not just to look for their body parts.

XIII. Irreversibility Is Not Empirical

In addition to confounding what functions with its functioning, the criteria for 'brain death' introduce further obfuscation through the use of the term 'irreversibility' and its cognates. To clarify the word 'irreversible':
Now, irreversibility as such is not an empirical concept and cannot be empirically determined. Both destruction of the brain and the cessation of its functions are, in principle, directly observable; such observations can serve as evidence. Irreversibility, however, of any kind, is a property about which we can learn only by inference from prior experience. It is not an observable condition. Hence, it cannot serve as evidence, nor can it rightly be made part of an empirical criterion of death.[76]
To regard irreversibility of cerebral (or brain) functioning, function or functions (at best, a deduction from a set of symptoms) as synonymous or interchangeable with destruction of the entire brain (one but not the only possible cause of these symptoms) is to commit a compound fallacy: identifying the symptoms with their cause and assuming a single cause when several are possible.
Perhaps the strongest argument against the identification of irreversible cessation of all brain functions with death is this: those who initially accepted 'brain death' did not really accept the identification themselves. The Harvard Committee was well aware of their intent and actions by clearly stating that they recommended that the patient be declared dead before any effort is made to take the patient off a respirator. Their reasoning for this recommendation, evidenced by their own statement, was to provide legal protection to those

[75] P.A. Byrne, S. O'Reilly, P.M. Quay, et al., *The Patient, The Physician and Society*, in "Gonzaga Law Review", 18, 3, 1982/1983, pp. 429-526, now published (with updated additions) in *Beyond Brain Death. The case against brain based criteria for human death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, Dordrecht, Kluwer Academic Publishers, 2000, pp. 21-89.

involved: "Otherwise, the physicians would be turning off the respirator on a person who is under strict, technical application of law, still alive."
For, if "irreversible cessation of all brain functions" were merely other words for saying "complete destruction of the entire brain," why would there be the least hesitation on the part of proponents and others with a vested interest to drop all reference to "brain function" and to ease their opponents' fears by substituting "complete destruction of the entire brain?" But, in fact, the proponents have vigorously resisted efforts to make this replacement. Yet surely, no function of a brain could survive that brain's complete destruction. Unfortunately, it seems that valuable evidence to settle these questions could have been obtained if the brains were studied at the time of organ harvesting over the years since 1968.
What lies behind the resistance to the identification that 'brain death' proponents have so constantly used and without which their basic arguments collapse? If the only brain functions remaining were firings of a few isolated neurons or the like, perhaps all this would not matter much. But since death is to be constituted by irreversible cessation of all brain functions as determined in accordance with one of the more than 30 disparate sets of criteria within "acceptable" standards of medical practice, and since one or more of the other sets might not be fulfilled, there is nothing to prevent *any* of the characteristic functions of the component brain parts from being declared 'peripheral'. For it is certain that not one of them can be declared to be the function that alone makes the whole person live. Cortical activity was evidently regarded as peripheral by the Minnesota criteria when reticular formation function has ceased, and by the British criteria when the brainstem's functions are gone due to structural damage. Many today argue that midbrain activity or brainstem activity is peripheral once the cortex has ceased to function. There is no limit to what real functions may be declared peripheral when the only non-peripheral function is imaginary. There continues to be no global consensus,[77] and unresolved issues remain worldwide.[78]
Further, if complete destruction of the brain were what really is intended, then why is so much written concerning indefinite ventilation of 'cadavers' and the like? If a patient whose whole brain has been destroyed is on a ventilator, this is very critical and very likely the patient will not survive very long. However, as physicians, we would hasten death if we remove the ventilator of that particular patient who is near death, yet still alive. If his brain is not destroyed but merely nonfunctioning, then ventilatory support *should* be continued, at least as long as there is any chance of effecting a recovery or of seeking a, as yet unknown, way to reverse his presently irreversible lack of function.[79]
When there is a genuine doubt of fact, who protects the defenseless comatose patient?

[77] E.F.M. Wijdicks, *Brain death worldwide. Accepted fact but no global consensus in diagnostic criteria*, in "Neurology", 58, 2002, pp. 20-25.
[78] M. Swash, R. Beresford, *Brain death: Still-unresolved issues worldwide (editorial)*, in "Neurology", 58, 2002, pp. 9-10.

XIV. Recent Investigations

Elegant and innovative research by Dr. Cicero Coimbra[80] in brain-injured animals using criteria similar to 'brain death' confirms that with modern day technology, varying degrees of recovery can occur. Major vital organs have the ability to regenerate cells and/or shift performance to other normal or less compromised areas of the same organ. A good example is the myocardium, which can occasionally either regenerate or recover 'stunned' or 'hibernating' myocardium to improved levels of functioning.[81] Similarly, the brain can be 'stunned' in many ways. A prospective study of 'brain dead' patients could have a high cost, but markers for those with potential for partial or even total recovery might be identified. Obviously, the potential would be very worthwhile for those who would otherwise die following removal of their vital organs or if utilized as subjects for research/teaching or simply to have life- support measures discontinued when there might have been a tomorrow.
Many theological and religious aspects are not presented in this paper, but more were presented not too long ago.[82]

CONCLUSIONS

Brain related criteria for death, from initially using the term, 'brain death', was not and has not been based on studies that would be considered scientifically valid for any other medical purposes. The Harvard Criteria were published without any patient data. The Minnesota and the British Criteria did not require evaluation of electrical activity of the brain (EEG). There has been little or no chance to express public opposition to 'brain death'. In reality, 'brain death' is false and not true death. There is no way to obtain a heart for transplantion unless it is a healthy heart from a living patient. To remove a healthy unpaired vital organ suitable for transplantation from someone declared legally 'brain dead', but not truly biologically dead, is not ethically acceptable, i.e., evil may not be done that good might come of it. Can anything be done to change something false to be the truth?

Epilogue

The position of the Roman Catholic Church is based on the following, beginning with the Council of Vienne, 1311-1313:
Moreover, with the approval of the said council, we reject as erroneous and contrary to the truth of the catholic faith every doctrine or proposition rashly asserting that the substance of the rational or the intellectual soul is not of itself and essentially the form of the human body, or casting doubt on this matter. In

[80] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death*, in "Brazilian Journal of Medicine and Biological Research", 32, 12, 1999, pp. 1479-1487 (http://www.scielo.br/pdf/bjmbr/v32n12/3633m.pdf).
[81] S.J. Kim, A. Peppas, S.K. Hong, et al., *Persistent Stunning Induces Myocardial Hibernation and Protection - Flow/Function and Metabolic Mechanisms*, in "Circulation Research", 92, 2003, p. 1233; G. Parmar, A.V. Lalani, *The Sleeping Heart: Hibernating Myocardium*, in "Perspectives in Cardiology", 2001, pp. 44- 53.
[82] F.W. Bruskewitz, R.V. Vasa, W.F. Weaver, et al., *Are Organ Transplants Ever Morally Licit?*, in "Catholic World Report", 11, 3, 2001, pp. 50-56.

order that all may know the truth of the faith in its purity and all error may be excluded, we define that anyone who presumes henceforth to assert, defend or hold stubbornly that the rational or intellectual soul is not the form of the human body of itself and essentially, is to be considered a heretic.[83]

This position was reaffirmed by the Fifth Lateran Council, 19 December 1513.[84] The Catholic Catechism, citing the Council of Vienne, states that "[t]he unity of soul and body is so profound that one has to consider the soul to be the 'form' of the body …."[85]

Pope Pius XII in 1957 in his Address to Anesthesiologists stated:

But considerations of a general nature allow us to believe that human life continues for as long as its vital functions – distinguished from the simple life of organs – manifest themselves spontaneously or even with help of artificial processes.[86]

In the same Address Pope Pius XII stated:

In case of insoluble doubt, one must resort to presumptions of law and of fact. In general, it will be necessary to presume that life remains, because there is involved here a fundamental right received from the Creator, and it is necessary to prove with certainty that it has been lost.[87]

Also, Pope Pius XII in an Address about corneal transplantation stated:

Public authorities and the laws which concern the use of corpses should, in general, be guided by these same moral and human considerations, since they are based on human nature itself, which takes precedence over society in the order of causality and in dignity. In particular, public authorities have the duty to supervise their enforcement and above all to take care that a 'corpse' shall not be considered and treated as such until death has been sufficiently proved.[88]

In 1991 Pope John Paul II to a Group on Organ Transplants:

Furthermore, a person can only donate that of which he can deprive himself without serious danger or harm to his own life or personal identity, and for a just and proportionate reason. It is obvious that vital organs can only be donated after death.[89]

Pope John Paul II said to the Participants of the 1989 Pontifical Academy of Sciences:

The problem of the moment of death has serious implications at the practical level, and this aspect is also of great interest to the Church. In practice, there seems to arise a tragic dilemma. On the one hand there is the urgent need to find replacement organs for sick people who would otherwise die or at least would not recover. In other words, it is conceivable that in order to escape certain and imminent death a patient may need to receive an organ which could be provided by another patient, who may be lying next to him in hospital, but about whose death there still remains some doubt. Consequently, in the process there arises the danger of terminating a human life, of definitively disrupting

[83] Council of Vienne 1311 – 1312.
[84] Fifth Lateran Council, 1512 – 1517.
[85] *Catechism of the Catholic Church*, Part I, Section 2, Chapter 1, Article 1, § 6, n. 365.
[86] Pius XII, *To an International Congress of Anesthesiologists, Nov. 24, 1957*, p. 397.
[87] Id.
[88] Pius XII, *To the delegates of the Italian Association of Cornea Donors and the Italian Union for the Blind, May 14, 1956*, in "Acta Apostolicae Sedis", 48, 1956, pp. 464–465.
[89] John Paul II, *To the participants at the first International Congress on the Transplant of Organs*, June 20, 1991, in *Insegnamenti* XIV/1 and "L'Osservatore Romano", n. 25- 24, June 1991.

the psychosomatic unity of a person. More precisely, there is a real possibility that the life whose continuation is made unsustainable by the removal of a vital organ may be that of a living person, whereas the respect due to human life absolutely prohibits the direct and positive sacrifice of that life, even though it may be for the benefit of another human being who might be felt to be entitled to preference.[90]
In the same Address Pope John Paul II stated:

Death can mean decomposition, disintegration, a separation. (cf. *Salvifici Doloris*, n.15; *Gaudium et Spes*, n. 18). It occurs when the spiritual principle which ensures the unity of the individual can no longer exercise its functions in and upon the organism, whose elements left to themselves, disintegrate.[91]

Pope John Paul II stated in *Evangelium Vitae*:

Nor can we remain silent in the face of other more furtive, but no less serious and real, forms of euthanasia. These could occur for example when, in order to increase the availability of organs for transplants, organs are removed without respecting objective and adequate criteria which verify the death of the donor.[92]

It follows that the question must be asked: Are criteria that are used objective and adequate to verify the donor's death when a heart and other organs are taken for transplantation? That is, is life no longer present when the heart is beating and there is a recordable blood pressure, normal temperature, normal salt and water balance and many internal organs and systems are functioning and maintaining the unity of the body?[93]
Pope John Paul II addressed the 18th International Congress of the Transplantation Society on August 29, 2000.[94] The Holy Father stated that the decision to donate organs:

[R]equires that individuals be properly informed about the processes involved, in order to be in a position to consent or decline in a free and conscientious manner ... Naturally, an analogous consent should be given by the recipients of donated organs.
[V]ital organs which occur singly in the body can be removed only after death, that is from the body of someone who is certainly dead. This requirement is self-evident, since to act otherwise would mean intentionally to cause the death of the donor in disposing of his organs.

[90] John Paul II, *Discourse to the Participants of the Working Group*, in *Working Group on the Determination of Brain Death and its Relationship to Human Death. 10-14 December, 1989*, edited by R.J. White, H. Angstwurm, I. Carrasco de Paula, Vatican City, Pontifical Academy of Sciences, 1992, pp. XXIII-XXVII (p. XXVI).
[91] Ibid., p. XXV.
[92] John Paul II, *Evangelium Vitae*, 25 March 1995, § 15.
[93] P.A. Byrne, S. O'Reilly, P.M. Quay, *Brain Death - An Opposing View Point*. See also: P.A. Byrne, J.C. Evers, *Brain Death, Still a Controversy*, "The Pharos", 53, 4, 1990, pp. 10-12; P.A. Byrne, S. O'Reilly, P.M. Quay, et al., *The Patient, The Physician and Society*; P.M. Quay, *Utilizing the Bodies of the Dead*, in "St. Louis University Law Journal", 28, 4, 1984, pp. 889-927, P.A. Byrne, W.F. Colliton, E.F. Diamond, et al., *The Physician's Responsibility Toward Sacred Human Life*, in "Linacre Quarterly", 1986, pp. 14-21; P.A. Byrne, R.G. Nilges, *The Brain Stem in Brain Death: A Critical Review*, in "Issues in Law and Medicine", 9, 1, 1993, pp.3- 21; P.A. Byrne, J.C. Evers, R.G. Nilges, *Anencephaly - Organ Transplantation*, in "Issues in Law and Medicine", 9, 1, 1993, pp. 3-33.
[94] John Paul II, *Address of 29 August 2000 to the 18th International Congress of the Transplantation Society*, in "L'Osservatore Romano", Vatican City, August 2000, pp. 1-2 (www.vatican.va/holy_father/john_paul_ii/speeches/2000/jul-sep/documents/hf_jp-ii_spe_20000829_transplants_en.html).

[T]he death of the person is a single event, consisting in the total disintegration of that unitary and integrated whole that is the personal self. It results from the separation of the life-principle (or soul) from the corporal reality of the person. The death of the person, understood in this primary sense, is an event which no scientific technique or empirical method can identify directly.
[T]he 'criteria' for ascertaining death used by medicine today should not be understood as the technical-scientific determination of the exact moment of a person's death, but as a scientifically secure means of identifying the biological signs that a person has indeed died.
It is a well-known fact that for some time certain scientific approaches to ascertaining death have shifted the emphasis from the traditional cardio- respiratory signs to the so-called 'neurological' criterion. Specifically, this consists in establishing, according to clearly determined parameters commonly held by the international scientific community, the complete and irreversible cessation of all brain activity (in the cerebrum, cerebellum and brain stem). This is then considered the sign that the individual organism has lost its integrative capacity. [Emphasis by authors. The Holy Father said "considered," not "is."]
With regard to the parameters used today for ascertaining death - whether the 'encephalic' signs or the more traditional cardio-respiratory signs - the Church does not make technical decisions. She limits herself to the Gospel duty of comparing the data offered by medical science with the Christian understanding of the unity of the person, bringing out the similarities and the possible conflicts capable of endangering respect for human dignity.
Here it can be said that the criterion adopted in more recent times for ascertaining the fact of death, namely the complete and irreversible cessation of all brain activity, if rigorously applied, does not seem to conflict with the essential elements of a sound anthropology.

This Address by Pope John Paul II implies that the Holy Father believed that there was only one neurological "criterion" for "the complete and irreversible cessation of all brain activity" that has been "rigorously applied." It must be pointed out that there is no one neurological criterion. There is no global consensus in diagnostic criteria[95] and there are still unresolved issues.[96]

[95] E.F.M. Wijdicks, *Brain death worldwide. Accepted fact but no global consensus in diagnostic criteria*, pp. 20-25.
[96] M. Swash, R. Beresford, *Brain death: Still-unresolved issues worldwide (editorial)*, pp. 9-10.

None of the criteria have been evaluated for "complete and irreversible cessation of all brain activity." None have been "rigorously applied." It is noteworthy that the Holy Father has never used the term 'brain death' in any publicized statement.

The Holy Father pointed out the requirement for the donor and recipient to be properly informed. This would have to include information about the differences in the many disparate criteria and how one could be declared dead by one, but the same identical person at the same time is living according to different criteria.

In *Evangelium Vitae* (§ 86), the Holy Father suggested that one way of nurturing a genuine Culture of Life is the donation of organs, performed in an ethically acceptable manner. A manner that is ethically acceptable is one that corresponds to the Natural Moral Law and its four axioms: (1) Good ought to be done, and evil must be avoided. (2) Good may not be withheld. (3) Evil may not be done. (4) Evil may not be done that good might come of it.

Thus the harvesting of organs in a manner that would bring about the debilitating mutilation or the death of the donor would not be ethically acceptable. The human authenticity of such a decisive gesture requires the individuals to be properly informed about the processes involved, in order to be in a position to consent or decline in a free and conscientious manner.

To be properly informed, the person considering organ donation should be educated about the nature of vital organ transplantation. In particular, he should be advised that prior to excision, his heart is healthy and capable of normal circulation and respiration, but after any vital organ necessary and required to live has been removed from his body, he will die.

Freedom consists in the liberty to exercise one's free will in accordance with right reason, which seeks good and avoids evil. To murder oneself or another can never be in accord with right reason.

Thus, adherence to the restrictions already stipulated and the prohibitions imposed by God Himself in the Natural Moral Law precludes the transplantation of unpaired vital organs, an act that causes the death of the donor and violates the Fifth Commandment of the Divine Decalogue, "Thou shalt not kill" (Deut. 5:17).

Genuine Science or False Philosophy?

Roberto de Mattei

It is a well-known fact that up until the 60s, Western judicial and medical tradition believed that the acknowledgement of death should be carried out through the confirmation of the definitive cessation of all vital functions: that is breathing, blood circulation and activity of the nervous system.[1] The doctor's task was then to ascertain the occurrence of death, not to establish the exact moment it took place.

In August 1968, an 'Ad Hoc' Committee instituted by Harvard Medical School set forth a new criterion for the ascertainment of death based on entirely neurological evidence: that is on the definitive cessation of all brain activity, under the definition of "irreversible coma."[2]

The Committee's Final Report which was published on the "Journal of the American Medical Association" in August 1968, reads as follows:

Our primary purpose is to define irreversible coma as a new criterion for death.

There are two reasons why there is a need for a definition. (1) Improvements in resuscitative and supportive measures have led to increased efforts to save those who are desperately injured. Sometimes efforts have only a partial success so that the re-

[1] *R. Barcaro,* La questione della morte cerebrale nell'attuale dibattito bioetico*, Ph.D. Dissertation in Bioethics, University of Genoa, Faculty of Law, Genoa, 2004, p. 4f.*

[2] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death*, in "Journal of the American Medical Associa- tion," 205, 1968, p. 337-340. For further information on the 'turning point' see M. Giacomini, *A change of heart and a change of mind? Technology and the redefinition of death in 1968*, in "Social Science and Medicine," 44, 10, 1997, p. 1465-1482 and E.F.M. Wijdicks, *The neurologist and Har- vard criteria for brain death*, in "Neurology," 61, 2003, p. 970-976.

sult is an individual whose heart continues to beat but whose brain is irreversibly damaged. The burden is great on patients who suffer permanent loss of intellect, on their families, on the hospitals, and on those in need for hospital beds already occu- pied by these comatose patients. (2) Obsolete criteria for the definition of death can lead to controversy in obtaining organs for transplantation.[3]

It is easily understood from the above passage how the new criteria for the definition of death set forth by the Harvard Committee were nothing else than an answer to utterly 'utilitarian' needs and demands. In its Final Report in fact, the Committee does not take into consideration the scientific data on the death of the patients, but rather considers them to be, on the one hand, nothing more than a 'burden' to themselves and to society since they are irreversibly damaged, and, on the other hand, of possible use to society as potential organ donors for transplants.

It is not a chance that the 'Ad Hoc' Committee chaired by the anaesthetist Henry Knowles Beecher (1904–1976) and composed of 13 members, 10 of which physicians, convened immediately after the first heart transplant carried out in December 1967 by the South African surgeon Christiaan Barnard (1922– 2001) in Cape Town, and within only 6 months the Final Report was completed. In a letter to Robert Ebert, Dean of Harvard Medical School, Beecher wrote: "The time has come for a further consideration of the definition of death. Every major hospital has patients stacked up waiting for suitable donors."[4] This is a clearly wholly utilitarian perspective, whereby what matters the most is not to define who is really dead, but who is 'convenient' to pronounce as such.

Ongoing debates ensued brought about also by the criticism raised by in- ternationally well-known personalities such as the philosophers Hans Jonas[5] and Peter Singer.[6] In order to respond to the main objections thus raised, the

[3] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death*, p. 337.

[4] Letter by Henry K. Beecher to Robert Ebert, 30 October 1967. Quoted in D. Rothman, *Strangers at the Bedside*, New York, Basic Books, 1991, p. 160-161.

[5] H. Jonas, *Against the Stream: Comments on the definition and Redefinition of Death*, in *Philo sophical Essays: From Ancient Creed to technological man*, Englewood Cliffs, N.J., Prentice Hall, 1974, p. 132-140; H. Jonas, *Philosophical Reflections on Human Experimentation*, in "Daedalus" 98, 2, 1969, p. 219-247.

[6] P. Singer, *Rethinking Life & Death. The Collapse of Our Traditional Ethics*, New York, St. Martin's Press, 1994; P. Singer, *Unsanctifying Human Life*, Edited by H. Kuhse, Malden, MA, Blackwell, 2002, p. 246-265.

President's Commission for the study of ethical problems in medicine and behavioural research was appointed in the United States, and it published in 1981 a new paper under the title *Defining Death*;[7] wherein the concept of brain death is based on the criteria of "whole brain death": the brain is in fact considered the organ indispensable for human body integration. The irre- versible cessation of all brain functions brings about the permanent loss of all integration among the several components of the human body and, as a con- sequence, the death of the human being.

Following publication of the above-mentioned paper which was an ideal completion of the Harvard report, the definition of death was changed in al- most all the United States, and, subsequently, also in most so-called devel- oped countries. Japan alone resisted such change up until 1999. In Italy the 'turning point' was marked by the introduction of Law No. 578 dated 29 De- cember 1993 (*Guidelines for the declaration and certification of death*), Art. 1 of which reads as follows: "Death is defined by the irreversible cessation of all brain functions." The concept of brain death was thus incorporated into both legal and medical practice in the majority of States throughout the world, even if consensus among experts in the field is far from unanimous.[8] Starting from the 90s, a rising number of objections and criticisms were raised with regards to the validity of such definition of brain death.[9]

Scientific or Philosophical Theory?

The definition of brain death constitutes an archetypical example of that kind of blurring between the scientific and the ethical and philosophical lev- els which so often characterizes bioethics, also on the Catholic side.

[7] President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: A Report on Medical, Legal, and Ethical Issues in the Deter mination of Death*, Washington D.C., U.S. Government Printing Office, 1981.

[8] On the current debate, see among others: E.F.M. Wijdicks, *Brain death world wide. Accepted fact, but no global consensus in diagnostic criteria*, in "Neurology" 58, 2002, p. 20-25; R. Barcaro, *La questione della morte cerebrale*; R. Barcaro, P. Becchi, *La 'morte cerebrale' è entrata in crisi irre- versibile?*, in "Politica del Diritto," XXXIV, 4, 2003, p. 653-679; R. Barcaro, P. Becchi, *Morte cere- brale e trapianto di organi*, in "Bioetica," XII, 1, 2004, p. 25-44. See also the concluding bibliogra phy to the anthology of articles edited by R. Barcaro, P. Becchi, *Questioni mortali. L'attuale dibatti- to sulla morte cerebrale e il problema dei trapianti*, Naples, Edizioni Scientifiche Italiane, 2004.

[9] R.D. Truog, J.C. Fackler, *Rethinking Brain Death*, in "Critical Care Medicine," 20, 12, 1992, p. 1705-1713.

On the scientific level in fact, the clinical technician or the biologist can only acknowledge the presence of life, or, on the contrary, the advent of death, in a human being but does not, under any circumstances, have the competence to define what is life and what is death unless he forgets being a scientist and becomes a philosopher. Medicine, as a matter of fact, cannot avow on the essence of life, neither can it define with accuracy its precise first and last moments. The medical pretension to apply biological parameters to notions of life and death is nothing else than what we know as "Bioscientism."
Josef Seifert was one among the first experts in the field to rightly point out that defining a human being in a state of irreversible coma dead is not in itself a medical assumption, but rather a philosophical one.

From a *medical* point of view it cannot be argued that since someone's brain does no longer work, while all other vital functions are intact, that *person as a human be- ing who is endowed with a body,* is no longer alive. While on the irreversibility of the cessation of brain activity, *only or at least in most cases, medicine can deliberate com- petently*, in no way, *only or at least in most cases, should it or could it deliberate* if the death of the brain is also the *actual death* of the human being. Every physician who debates about it, does so as a doctor in philosophy, not as a doctor in medicine.[10]

Along the same lines, Robert Spaemann recalling Aristotle's dictum: "*Vi- vere viventibus est*," writes as follows:

For a living being, not to live means ceasing to exist. Being, however, is never an object of natural science. It is in fact the '*primum notium*' of reason and as such sec- ondarily an object of metaphysical reflection.[11]

But even Peter Singer, a writer whose anthropological philosophy is quite the opposite of that of Seifert and Spaemann, has always underlined ever since the 70s, the scientific inconsistency inherent the definition and the notion itself of brain death. According to Singer in fact, the Harvard Committee did nothing more than pass an 'ethical' judgement under the guise of a

[10] J. Seifert, *La morte cerebrale non è la morte di fatto. Argomentazioni filosofiche,* in *Questioni mortali*, edited by R. Barcaro and P. Becchi, p. 79.
[11] R. Spaemann, *Is Brain Death the Death of Human Being*? *On the current State of the Debate,* in this volume.
By the same author see also: *Personen. Versuche uber den Unterschied zwischen 'etwas' und 'je- mand'*, Stuttgart 1996, p. 252-264.

scientific one, acting on the basis of a merely utilitarian stimulus. The con- troversial Australian philosopher believes however, just like the Harvard Committee does, that a patient can be eliminated if this is of some use to society. He argues for instance that killing a newborn baby is not equivalent on a moral level to killing a rational and self-conscious human being.[12] Nevertheless there is no need in his view to conjure up a purpose-made fictitious definition of brain death: it is preferable to face up to the responsibility of taking an 'ethical' decision to this purpose, also if it is in sharp contrast with the whole Western religious and juridical tradition.

The notion of brain death is however consistent with modern thinking in- herent materialism which in fact identifies the vital core of the human being in brain activity itself.[13] This is the theory of doctor-philosopher La Mettrie,[14] and of the Enlightenment and Marxism which Lenin so clearly summed up in his 1908 philosophical essay entitled *Materialism and Empiriocriticism*. In it Lenin argues without any hesitation that, quoting Engels' words, the definition of thought and consciousness is that of "products of the human brain"[15]:

our consciousness and thinking, however suprasensuous they may seem, are the product (*Erzeugnis*) of a material, bodily organ, the brain. Matter is not a product of mind, but mind itself is merely the highest product of matter. This is, of course, pure materialism.[16]

Quite opposite is, however, the philosophical tradition which has informed all Western civilization, its moral codes and laws throughout the centuries. What I am referring to in this case is the notion that a human being is made up of soul and body and, indeed in its spiritual soul resides his vital core.[17] This fundamental essence is to be found within the body, but it is not

[12] See further to quoted volumes, the Conference by Peter Singer on 24 September 2005 in Pordenone, as anticipated by "L'Espresso" issue no. 36, 9 -15 September 2005.

[13] See L. Bossi, *Storia naturale dell'anima*, Milan, Baldini Castoldi Dalai Editore, 2005.

[14] J. Offray de La Mettrie (1709-1751) is well-known for *L'Homme-Machine* (1757), wherein he equates the soul to the 'brain' as the informing principle behind all human functions and ac tivities. (see edition by Princeton University Press, Princeton 1960, p. 151-154 and passim).

[15] Vladimir Il'iã Ul'janov Lenin, *Materialismo ed empiriocriticismo*, in *Opere complete*, Italian translation, Rome, Editori Riuniti, 1963, vol. XIV, p. 83- 90.

[16] Ibid., p. 84.

[17] See C. Fabro, *L'anima. Introduzione al problema dell'uomo*, Rome, Editrice del Verbo In- carnato, Segni, 2005.

blood, brain or breathing. According to Aristotle, "it is the soul by or with which primarily we live, perceive, and think"[18] or more precisely, "the pri- mary perfection of a natural organic body."[19] Within this particular perspec- tive, human life begins with the infusion of the soul into the body and ends with its separation from it, when the body dissolves in its elements.

As a consequence of the above theory, the fact that from an organic or biological point of view there is no substantial difference from the moment of conception to the moment of birth,[20] does not mean that from a philo- sophical viewpoint there is the certainty that the soul permeates the body at the moment of conception. The certainty of the existence of a perfect con- tinuity of embryonic development only goes to show a kind of biological identity, not necessarily a human one. The newly-conceived embryo is with- out doubt an individual with its own coherent genetic baggage and pro- gramme, but not necessarily a human being since only the soul brings along with it the quality of 'humanity' to the individual. One can even accept the existence of a distinction between biological living and human life, provid- ed one also acknowledges that what in truth really makes a man is neither self-consciousness nor social interaction but rather the rational soul that is in turn the 'substantial form' of the body. Obviously 'rational soul' does not by any means indicate the intellectual functions of an individual, but rather the presence within the individual of a life principle of a spiritual nature which encompasses within itself, the potentiality of the operation of those functions.

All Christian philosophers agree that ever since the moment of concep- tion the newly-formed being possesses a soul without which it could not live. However, vegetative life is different from rational life. When endeavouring to explain the origin of the soul which every single individual possesses, a num- ber of bioethicists risk falling into the old theory of traducianism: that is the belief that parents at the moment of conception together with the body also transmit the soul to their child through the organic function of life genera- tion.[21] Such theory was refuted by St Thomas of Aquinas, according to him in fact "the bodily semen transmitted from Adam does not of its own power

[18] Aristotle, *De Anima*, II, 414a, 12-13.

[19] Aristotle, *De Anima*, II, 412b, 5-6.

[20] See for instance, A.L. Vescovi, L. Spinardi, *La natura biologica dell'embrione*, in "Medici- na e Morale," I, 2004, p. 53-63 (p. 60-61).

[21] Tertullian, *De anima*, c. 22, 27.

produce the rational soul, but disposes the matter for it";[22] and "the rational soul which is not transmitted by the parents, is infused by God as soon as the human body is apt to receive it."[23]

For him, the rational soul in fact, or any other type for that matter, can- not be received by a subject who is not suitable and proportionate.[24]

The main point of discussion concerns the exact moment in which the ra- tional soul is infused into the body, God being its one and only inspiring and originating source. Throughout history two philosophical solutions to this question have been formulated: the theory of 'immediate' soul animation and the notion of 'delayed' soul animation.[25] The first of these theories argues that the soul enters the body at very moment of conception. According to this the- ory in fact, the fertilised egg whose chromosomes already carry the whole ge- netic heritage of the individual, is right from the very first moment ready to receive the soul and so it does. This is nowadays the prevailing and widely- accepted theory among philosophers and theologicians. The notion of 'delayed' soul instillation as formulated by St Thomas[26] and a number of other ancient and modern authors,[27] consists in the belief that "the soul is in the embryo, the nutritive soul from the beginning, then the sen- sitive, lastly the intellectual soul."[28] The human foetus would therefore be shaped by three distinct vital principles: the nutritive soul which is present at the very moment of conception, the sensitive one which follows and, in the end, the intellectual soul which is infused by God when the embryo is devel- oped enough to receive it.

[22] St. Thomas Aquinas, *Summa Theologica*, Latin with Italian translation, Bologna, Edizioni Studio Domenicano, 1984: II – IIae, quaestio 83, article 1, ad 3.

[23] St. Thomas, *Summa Theologica*, I, q. 118, a. 2.

[24] St. Thomas, *Summa Theologica*, I, q. 100, a. 1, ad 2.

[25] A. Chollet, entry *Animation*, in *Dictionnaire de Théologie catholique*, Paris, Letouzey et Ané, 1931, vol. I, coll. 1306-1320.

[26] See St. Thomas, *Quaestiones Disputatae. De potentia*, q. III, a. 9 ad 9; *Contra Gentiles*, II, Ch. 88; *Quod. libet.*, I, 9; IV, 6; *Summa Theologica*, I, q. 118, art. 2; *In IV Sent.*, l. II, dist. XVIII, q. II, a.3; *De Anima*, a 11, a. 1. Dante also draws on this theory (*Purgatory*, XXV, 18-25).

[27] See among others M. Liberatore s. j., *Dell'anima umana*, Ch. VII, a. 4; Cardinal D.J. Mercier, *Psychologia*, Part II, 1912, p. 330-332, no. 244; A. Sertillanges, o.p., *Les grandes thèses de la philoso- phie tomiste*, Bloud et Gay, Paris, 1928, p. 204; A. Lanza, *La questione del momento in cui l'anima razionale è infusa nel corpo*, Roma, Pontificio Ateneo Lateranense, 1939; P. Meth, M. Hudeczek o.p., *De Tempore animationis foetus umani secundum Embryologiam hodiaernam*, in "Angelicum," XXIX, 1952, p. 163-181; A. Zacchi o.p., *L'uomo*, Roma, Libreria Editrice F. Ferrari, 1954, p. 443-446; M. Alessandri, R. Masi, *Sull'origine dell'anima umana*, in "Euntes docete," 1955, p. 60-95.

[28] St. Thomas, *Summa Theologica*, I, q. 118, a. 2, ad 2.

One should indeed remember that St Thomas believes, in opposition to Pla- tonic tricotomy, that the rational soul is the one and only 'substantial form' of human being: it is therefore a succession, not a co-existence, of distinct cate- gories of soul. From "the one form which is the intellectual soul, man derives not only his being 'human', but also sensitive, vital and a natural organic body."[29]

The notion of 'immediate' soul animation is the most widespread; never- theless, in the words of Father Zacchi, "the reasons behind St Thomas' theo- ry are all but negligible."[30] Msgr Antonio Lanza († 1951), Bishop of Reggio Calabria who devoted an important volume to this very issue, believes that St Thomas' theory relatively unsuccessful fate among the experts is to be ex- plained not on the basis of recent scientific discoveries, but rather is caused by the decreasing interest in scholastic speculations and the general prevailing of practical over theoretical preoccupations in the investigation of problems.[31]

The Church for its part, has always wanted to mark a clear distinction be- tween the philosophical investigation of this issue and a practical evaluation of a legal and moral nature. "Catholic believers – Catholic Encyclopaedia reads – are perfectly free to accept whichever theory they find more appro- priate. Therefore for its part, the Church considers guilty of the crime of abortion all those who secure the expulsion of the human embryo, whatever the state of its development may be; but by it, it does not mean to propose a theoretical definition of this age-old issue.[32] Along the same lines, the Docu- ment of the Sacred Congregation for the Doctrine of the Faith *Donum Vitae* (1987) which in turn constitutes the foundation of the Encyclical of Pope John Paul II *Evangelium Vitae* (1995).

Catholic Point of View: in dubio pro vita?

"Certainly no experimental datum can be in itself sufficient to bring us to the recognition of a spiritual soul,"[33] one can read in the "Instruction on re- spect for human life in its origin and on the dignity of procreation - replies to

[29] St. Thomas, *Summa Theologica*, I, q.76, a.3.
[30] A. Zacchi, *L'uomo*, p. 444.
[31] A. Lanza, *La questione del momento in cui l'anima razionale è infusa nel corpo*, p. 294.
[32] G. Bosio, entry "*Animazione,"* in *Enciclopedia cattolica*, vol. I, col 1354.
[33] Sacred Congregation for the Doctrine of the Faith, *Donum Vitae* (1987). *Instruction on Re spect for Human Life in its origin and on the dignity of procreation - replies to certain questions of the day*, (22 February 1987), n. I, 1: in "Acta Apostolicae Sedis," 80, 1988, 79.

certain questions of the day" by the Congregation for the Doctrine of the Faith. The Congregation maintains its refusal to take a position on the issue concerning the moment of soul infusion and rightly so; the same goes for the moment in which it leaves the body. If it is in fact not possible to prove em- pirically that the spiritual soul already exists in the embryo, the same goes for proving that the soul is separated from the body in the brain – dead individ- ual.[34] If truth be told, both the initial and final moments of life are shrouded in deep mystery. The Magisterium of the Church has thus left the philo- sophical issue of the infusion of the soul on the side, but nevertheless has al- ways argued with fervour the existence of a moral duty to behave in all mat- ters regarding the human embryo, as if towards a real and true human being, right from its conception. From an ethical point of view, the embryo must be treated as if it was a person, exactly because it is not possible to rule out - or rather, on the contrary, it is very likely - that the soul is in the body right from the very first moment of conception. The doubt alone which exists about the human identity of the newly-formed embryo calls for a moral duty to avoid all danger to it in consideration of the fact that one could run the risk of killing a human being. The presence or lack of soul in the embryo, does not, in any case, infringe on the immoral quality of any aggression against it; what changes is only the degree of immorality of an act which is by its own nature, utterly immoral. If the soul is indeed present, it becomes a murder, if it is not, is an attack to the source itself of human life.[35] The same moral condemna- tion applies to the use of the 'abortive' pill RU 486:

[34] Pope John Paul II often spoke on this subject: on 29 August 2000, at the International Con gress of the Society for Transplants, in a speech on 22 March 2004 and in a message to the meet ing organised by the Pontifical Academy of Sciences on 2-3 February 2005. The only certainty to be gathered from these interventions is that organ explants are only acceptable if they come from a donor who is positively and wholly dead. Within the Pontifical Academy for Life and the Pon tifical Academy of Sciences there persists a diversity of opinions on this subject to this day. The re sults of the First Symposium of the Academy for Life are published in the volume edited by R.J. White, H. Angstwurm, I. Carrasco de Paula, *Working Group on the determination of Brain Death and its Relationship to Human Death*, Vatican City, 1992. Among the many interventions from the Italian Catholic community against brain death, see R. de Mattei, *Speech to the Commission for So cial Affairs at the Chamber of Deputies*, Rome, 7 February 2002; the International Conference en titled "The Frontiers of Life: Science, Morals and Law, a comparison" organised in Rome on 25- 26 October 2002 by the Catholic Associations "Famiglia Domani" and "Fiducia." See also P. Bec- chi, *La posizione della Chiesa cattolica sul trapianto di organi da cadavere*, in "Rivista di teologia," 52, 2005, p. 389-401.

[35] As far back as 1679 a Decree by Pope Innocent XI firmly condemned all those who made an attempt on the life of the foetus on the pretence that it had no soul.

Furthermore, what is at stake is so important that, from the standpoint of moral obligation, the mere probability that a human person is involved would suffice to justify an absolutely clear prohibition of any intervention aimed at killing a human embryo. Precisely for this reason, over and above all scientific debates and those philosophical affirmations to which the Magisterium has not expressly committed it- self, the Church has always taught and continues to teach that the result of human procreation, from the first moment of its existence, must be guaranteed that uncon- ditional respect which is morally due to the human being in his or her totality and unity as body and spirit: "The human being is to be respected and treated as a per- son from the moment of conception; and therefore from that same moment his rights as a person must be recognized, among which in the first place is the inviolable right of every innocent human being to life."[36]

The moral principle of safeguard which the Church applies to the embryo, must, however, as a logical consequence, be extended also to the human being whose death has not been definitively ascertained. The purely natural, not miraculous, cases of 'return' to life of people who presented all the distinctive features of real death (such as lack of breathing and blood circulation, total loss of feeling etc.) show that between the moment of 'apparent' death and the moment in which death really occurs there elapses a period of time, be it long or short, of dormant life. The above-mentioned cases clearly prove that a man can still come back to life even after having been for whole hours in a state in which all vital functions such as conscience, brain waves, feeling and muscular movements, breathing and blood circulation have ceased.[37] This is kept into due consideration by the Church when its laws claim that as long as there may be a reasonable doubt, however small it may be, that the person could still be alive, the Holy Sacraments can, and indeed must, be administered to him/her. "It is much better to treat a dead man as if he were still alive" – Father Royo Marin says – rather than to treat a living man as if he were dead."[38] This is the reason why Can. 1005 of the new "Code of Canon Law" establishes that "this sacrament is to be administered in a case of doubt whether the sick person has attained the use of reason, is dangerously ill, or is dead."[39]

[36] John Paul II, *Evangelium Vitae,* 25 March 1995, § 60.
[37] See A. Michel, *Dictionnaire de Theologie Catholique*, Letouzey et Ané , Paris 1929 vol.X, coll. 2495-2496; J.B. Ferreres s.j., *La muerte real y la muerte aparente con relacion à los santos sacra- mentos, Estudio fisiologico-teologico,* Barcelona, E. Subirana, 1930.
[38] A. Royo Marin o.p., *Teología de la salvacíon*, Madrid, BAC, 1965, p. 262.
[39] See H. Abonneau, *Mort*, in *Dictionnaire de Droit Canonique*, Paris, Letouzey et Ané, 1957, vol. VI, coll. 943-954.

Both civil and religious laws have always "presumed" life over death of the in- dividual. Life begins when God infuses the soul into the body and ends when body and soul separate: the Church labels these two moments respectively as "con- ception" and "natural death" and clearly states as follows, that:

Nothing and no one can in any way permit the killing of an innocent human be- ing, whether a foetus or an embryo, an infant or an adult, an old person, or one suf- fering from an incurable disease, or a person who is dying. Furthermore, no one is permitted to ask for this act of killing, either for himself or herself or for another per- son entrusted to his or her care, nor can he or she consent to it, either explicitly or implicitly. Nor can any authority legitimately recommend or permit such an action[40].

Msgr Elio Sgreccia, President of the Academy for Life, has acknowledged the equivalence between clinical death and total brain death on the basis of the concept of the "permanent cessation of the functioning of the body as a whole."[41] He thus seems to attribute to the brain the role which belongs to the rational soul: that is that of "imparting a common organic direction to all the organs and all the functions which make up the body of every single living being."[42] Irreversible brain damage could prevent the soul "from informing, directing, managing and unifying the body, thus making it alive and significant in relation to the ego."[43] But is the integrity of the brain really the condition which allows the soul to effectively play its role? Is the encephalon the site of the soul or, more simply, a bodily instrument which becomes a tool for the rational soul to carry out its functions?
The paediatric neurologist Alan Shewmon has demonstrated how brain injuries do not cause the loss of ability, but rather of the functions coordinated by the encephalic trunk alone. In particular, Dr Shewmon's analysis

[40] Sacred Congregation for the Doctrine of the Faith, *Declaration on Euthanasia - Iura et bona* (5 May 1980), II: in "Acta Apostolicae Sedis," 72, 1980, 546. This declaration is reaffirmed at § 59 of Encyclical *Evangelium Vitae* (1995).
[41] Mons. E. Sgreccia, *Aspetti etici connessi con la morte cerebrale*, in "Medicina e Morale," XXXVI, 3, 1986, p. 515-526 (p. 523). Along the same lines, see C. Manni, *La morte cerebrale. As- petti scientifici e problemi etici*, in "Medicina e Morale," XXXVI, 3, 1986, p. 495-499; A. Rodriguez Luño, *Rapporti tra il concetto filosofico e il concetto clinico di morte*, in "Acta Philosophica," 1, 1992, p. 54-68. The review "Medicina e Morale" is often characterised by the publication of many articles written by advocates of the notion of 'brain death'.
[42] E. Sgreccia, *Aspetti etici connessi con la morte cerebrale*, p. 518.
[43] Ibid., p. 519.

clearly show that the encephalic trunk is not the organ responsible for the in- tegration of the different parts of the body. As a matter of fact, this system of integration is not to be found into one single organ, albeit important, such as the encephalon.[44] "Plants and embryos have no central integrating organ; rather, the integration is clearly a non-localized emergent phenomen involving the natural interaction among all the parts."[45]
Brain death, as Prof. Rainer Beckmann points out, does not produce an increasing disorganization of organs, tissues and cells of the body.

On the contrary, there is considerable order and integration: the spinal cord, temperature control, blood circulation, metabolism, the immune system and the gas exchange in the lungs function. Pregnant women are even capable of giving birth to a child. Especially this fact shows that very complex interactions between several organs (heart, lungs, liver, kidneys ect.), i.e. integration, is happening. […] The features of death, i.e. the end of the physical-spiritual unity and the biologi- cal unity of the organism as a whole, are not reliably indicated by the brain death criterion.[46]

Prof. Josef Seifert hence argues that:

Human life is much more than, and quite different from, integrated biological life in all basic body parts and many different cells and organs […] The conception of human life as an integrated whole of vital processes in organs and cells moves en- tirely on the level of purely vegetative life such as that of a plant and is even reduc- tionistic and insufficient regarding purely vegetative life […] essential connection between the human soul's life and biological life in the properly human sense […] in biologistic terms as the life of an integrated whole of organs […] biologistic con- cept of human life which leads both to a false concept of integrated life of the hu- man organism as a whole.[47]

[44] See D.A. Shewmon, *Recovery from 'Brain Death': A Neurologist's Apologia*, in "Linacre Quarterly," 64, 1997, p. 30-96; D.A. Shewmon, *'Brain Death' and Death: A Critical Re-Evalua tion of the Purported Equivalence*, in "Issues in Law & Medicine," XIV, 2, 1998, p. 125-145; D.A. Shewmon, *The Brain and Somatic Integration: Insights Into the Standard Biological Rationale for Equating 'Brain Death' With Death*, in "Journal of Medicine and Philosophy," XXVI, 5, 2001, p. 457-478.
[45] D.A. Shewmon, *Brain-Body Disconnection: Implication for the theoretical Basis of Brain death*, published in this volume.
[46] R. Beckmann, *Determining Death: Is Brain Death Reliable?*, published in this volume.
[47] See J. Seifert, *On 'brain death' in brief: philosophical arguments for and against equating it with actual death*, published in this volume.

Many advocates of the concept of brain death claim that the biological distinctiveness of the embryo presupposes the presence of the soul; howev- er, if the patient in a state of irreversible coma retains his/her biological be- ing intact, as they themselves acknowledge, one cannot understand why the latter should be considered as lacking that rational soul which one recognis- es to the embryo.[48]

The soul needs an organised bodily matter to give shape to; in fact it en- ters the body only once it is formed, and for the very same reason, it does not leave the body at the moment when its bodily functions cease, but rather when it is no longer ready to receive it and starts the process of disintegra- tion. "*Generatio non sequitur, sed praecedit formam substantialem*" in St Thomas's words.[49] The soul as a substantial shape of the body - Father Cor- nelio Fabro argues – receives the gift of existence in itself at first, and only secondarily it transmits it to the body once it has been generated; when the body is no longer able to accept it within itself with its potentiality and strength, the very same soul keeps hold of the act of being which it had pre- viously infused into the body, and continues to exist, taking on new forms of life.[50] The "*generatio*," i.e. the biological shaping of the body, does not fol- low, but rather precedes the infusion of the soul, just the way that biological death does not follow, but precedes that of the soul. It is not therefore the soul that abandons the body, but, on the contrary, the body that separates from the soul. Nothing prevents the loss of vital functions from happening progressively. But if we see death as a progression, we must consider the ces- sation of all brain activities to be nothing else than the beginning, and cer- tainly not the end, of the body progressive dissolution process.[51] The infusion of the soul as substantial shape of the body, is the end and not the beginning of the generative process, just as its separation from the body is the end and not the beginning of the body dissolution process.

The cessation of all brain activities can be (but it is not by default) a stage in the dying process. Nevertheless, the line separating life and death is com- plex and relatively vague. Prof. Ralph Weber points out that "Nobody knows

[48] In a leading article published on "Corriere della Sera" Ernesto Galli della Loggia rightly pointed out the contradictory position taken by many a Catholic on brain death, ascribing it to the Church (*Le contraddizioni della Chiesa*, in "Corriere della sera," 23 January 2005).

[49] St. Thomas, *Quaestiones Disputatae. De Potentia*, q. 3, a. 12.

[50] C. Fabro, *L'anima. Introduzione al problema dell'uomo*, p. 125

[51] See R. Barcaro, *La morte cerebrale totale è la morte dell'organismo? Appunti per una rifles- sione critica*, in "Materiali per una storia della cultura giuridica," XXV, 2, 2005, p. 479-500.

the exact boundary between life and death, and the brain criterion does not undo this ignorance."[52] Whichever is the moment of death, a common detail is certain: the life of a human being is not linked to the display of its faculties. The soul is a unique substantial being, however it has many and diverse operations which stem from it as branches from only one tree.[53] The embryo may not have developed neither intellect nor will, but it is a human being ever since the moment in which the soul has been infused in it; the old man who has fallen prey to senile dementia, the disable, the man in a coma are all human beings, even if deprived of their intellectual faculties. And it is indeed so, because one should never confuse the vital principle of a human being with his/her functions or faculties. To this purpose, Robert Spaemann appropriately remarks that:

Instead of concluding: where there is no longer any thinking, the *forma corporis* of the human being has disappeared, we can thus only conclude: as long the body of the human being is not dead, the personal soul is also still present.[54]

Nobody can demonstrate that brain death determines the separation of body and soul and therefore the effective death of the individual. There is a high possibility that brain-damaged body still retains a soul, just like the embryo almost certainly has one from the very first stage of its development. In both cases, we must reaffirm the principle of *in dubio pro vita*. When in doubt, one must presume that it is a living human being we are dealing with and therefore avoid all actions which could lead to a murder. These have always been the teachings of the Church on this subject and, over the Centuries, they have also been shared by the non-believers as the most appropriate way to protect and guarantee human beings' rights.

[52] R. Weber, *The Concept of Brain death and the Death of Man*, published in this volume.
[53] See St. Thomas, *Summa Theologica*, I, q. 77, art. 2, a 3.
[54] R. Weber, *The Concept of Brain death and the Death of Man*, published in this volume.

What is 'Brain Death'? A British Physician's View[**]

DAVID W. EVANS

The term 'brain death' came into common use amongst those working in Intensive Care Units (ICUs) some 40 years ago. It was not coined in any for- mal way as the name of a defined clinical syndrome. It was used in commu- nication between ICU staff as a "shorthand" term to describe the state of pa- tients who showed no sign of being able to breathe on their own after many days of mechanical ventilation, and whose coma appeared profound and deepening. When they lay inert and unresponsive, with circulatory instabili- ty and no external sign of brain function, they were often (and increasingly) described as 'brain dead'.

While there was, as I understood it, a general feeling that the brains of these patients were irrecoverably "out of business" - as a result of the trauma or disease process which had caused the apparently mortal brain damage - there was no pretence to certainty that there could be no residual life any- where within those brains. It was recognized that the clinical evidence avail- able could not support formal diagnosis of death of the whole of those brains as a matter of fact. There may have been, in the minds of the medical staff, an element of hope that they were really and truly dead - a hope strengthened if electroencephalography (EEG) was available and had recorded no intrin- sic electrical brain activity from scalp electrodes - for the clearly hopeless prognosis posed a management problem to which the only humane solution seemed to be discontinuation of life support to allow death to occur. How- ever, it was noteworthy and indeed inspiring to see members of the nursing

** Presented to the Conference on the "Signs of Death," The Pontifical Academy of Sciences, Vatican City, February 3-4, 2005.

staff still treating these inert and apparently insentient patients with gentle care, calling them by name and talking to them as if they might be comfort- ed thereby.
The decision to discontinue life support was not, as I recall, uniquely dif- ficult amongst the many onerous decisions which had to be made by those members of the medical staff with the seniority required for exercise of re- sponsibility in acute salvage and intensive care medicine. In those days when there was, perhaps, greater trust in the medical profession than exists today, there was no question of that decision being influenced by any consideration other than the interests of the patient and the peace of mind of the relatives and those caring for him. It was the practice to seek a consensus on the pro- posed action, by discussion with all those involved, after medical agreement about the futility of further life-sustaining treatment had been reached. The latter process included specialist neurological opinion when available, al- though it could usually do no more than confirm the potentially lethal nature of the brain damage, the depth of coma and the absence of reflexes (espe- cially some of those with arcs which pass through the brain stem). Confir- mation of ventilator dependence required that the ventilator be disconnect- ed for long enough to be sure that the brain stem respiratory centre was no longer responsive (the apnoea test). That test, while of crucial management importance, was known to carry risk of exacerbating the already critical sit- uation. It was, therefore, carried out only when a secure consensus that futile treatment should be discontinued had been reached. Then, if there was no sign of respiratory effort after prolonged disconnection - typically 10 minutes or more - there was, of course, no reason to re-establish mechanical ventila- tion.
In those early days of intensive care, practices inevitably varied between units - though within narrower limits as experience accrued - and national guidelines aimed at standardizing recognition of the state which might have been called mortal brain damage were clearly desirable. Conformity in the di- agnosis of this state, with its attached fatal prognosis and management im- perative, offered greater comfort and security to all concerned. News that the UK Conference of Medical Royal Colleges was preparing such guidelines was, therefore, welcomed. Its report, published in 1976,[1] formalized the pro- cedure to be used in establishing the futility (and impropriety) of continuing

[1] Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagno- sis of brain death*, in "British Medical Journal," 2, 1976, p. 1187-1188.

life support measures in comatose, ventilator-dependent patients. Its stated purpose was "to establish diagnostic criteria of such rigour that on their ful- filment the mechanical ventilator can be switched off, in the secure knowl- edge that there is no possible chance of recovery."[2] It specified the conditions to be satisfied before testing is carried out, with caveats about exclusion of cryptic causes of coma, and detailed the brain stem reflexes to be sought. The crucial apnoea test was limited to stimulation of the respiratory centre by po- tent hypercarbic drive, the ultimate anoxic drive stimulus being avoided by pre-oxygenation and diffusion of oxygen throughout the 10 minute discon- nection period. Resumption of mechanical ventilation was then envisaged, to allow for repetition of testing at some arbitrary interval - "to ensure that there has been no observer error" - and, presumably, if there was no observed respiratory effort on the second occasion, to keep the patient alive for a while longer in the interests of organ transplantation (the report was "written with the advice of the sub-committee of the Transplant Advisory Panel" - hence, perhaps, the less than stringent apnoea test).

Setting aside that glimpse of transplant interests even at that stage, and taking this Code of Practice (as it became known) at face value, the diagnos- tic criteria laid down in that 1976 report served the purpose of defining *a clin- ical syndrome to which an apparently unalterable short-term fatal prognosis at- tached*, any and all further treatment being pointless and unkind. In the re- port's words "They are accepted as being sufficient to distinguish between those patients who retain the functional capacity to have a chance of even partial recovery and those where no such possibility exists." It is unfortunate that Conference's report was published under the title "Diagnosis of Brain Death" - using the imprecise colloquial term in a formal and potentially mis- leading sense - for its criteria were clearly inadequate for the *de facto* diagno- sis of brain death, only a minute portion of the brain being tested at all and even those few more sensitive tests of global brain life and function which were available at the time being actively discouraged.

So that's what 'brain death' really is, viz. *a pre-terminal clinical syndrome* defined by criteria which, in the light of advances in the understanding of brain function and its powers of recovery, and the means of testing for it, can be expected to need modification as time goes by. In the nature of scientific progress, technologies with greater sensitivity and specificity will emerge and may, along with new therapeutic possibilities, demand a revision of clinical

Ibid., p. 1187.

practice in this presently dark field to a degree which might constitute up- heaval. It is essential, as in all fields of scientific endeavour, that the minds of those involved remain ever open to these possibilities.

I. *What 'Brain Death' is not*

As clinically diagnosed in accordance with the UK Code of Practice, 'brain death' is *not* the state in which it can be confidently said that there is no remaining life anywhere within the brain. The bedside tests prescribed simply lack the power to exclude persisting function - some of which is demonstrable by other means, which are not used - and still less can they de- tect elements of the brain which, though currently functionless, may yet re- tain power of recovery under optimal conditions. That being so, and since death is not a positive state and can be defined only in terms of the absence of life, it would be unscientific and intellectually dishonest to say that brains pronounced "dead" on the basis of the 1976 UK criteria are really and truly dead. Sadly, and seemingly without realizing the risk to its scientific credibil- ity, the Conference of the UK Medical Royal Colleges issued a Memorandum in 1979 which claimed that "brain death [as diagnosed by their 1976 crite- ria] represents the stage at which a patient becomes truly dead, because by then *all functions of the brain have permanently and irreversibly ceased*" (my italics).[3] That manifestly false claim was not formally abandoned until 1995, when it was "suggested that the more correct term 'brain stem death' should henceforth replace the term 'brain death' used in previous papers produced by the Conference of Colleges and the Department of Health."[4]

While undeniably "more correct," the term 'brain stem death' is nonethe- less scientifically inappropriate to describe the clinical syndrome diagnosed by Conference's Code of Practice, the elements of which have remained es- sentially unchanged since their promulgation in 1976. The prescribed testing of brain stem function is not rigorous, it ignores evidence of persisting medullary cardioregulatory function, and it declines to make use of special

[3] Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagno sis of death,* in "British Medical Journal," 1, 1979, p. 332.

[4] Working Group of the Royal College of Physicians, *Criteria for the diagnosis of brain stem death, Review by a Working Group convened by the Royal College of Physicians and endorsed by the Conference of Medical Royal Colleges and their Faculties in the United Kingdom,* in "Journal of the Royal College of Physicians," 29, 1995, p. 381-382.

techniques which can reveal active brain stem neural pathways.[5] Put simply, brain stems pronounced "dead" on the UK Code of Practice criteria cannot, with scientific integrity, be described as truly dead.[6]

II. *The 'Brain Death' Fallacy*

The deceptive argument that death of the brain, and therefore of the person, could be diagnosed clinically while the body remains alive and perfused by its naturally-beating heart, appears to have had its origins in Cape Town in 1967.[7] The 1968 Ad Hoc Harvard Committee charged with examining brain death gave it formal status - but, as Veatch now reveals, "none of the members was so naïve as to believe that people with dead brains (*sic*) were dead in the traditional biological sense of the irreversible loss of bodily inte- gration."[8] Instead, they "proposed an entirely new definition of death, one that assigned the label 'death' for social and policy purposes to people who no longer are seen as having the full moral standing assigned to other hu- mans." Whether or not that was the understanding of those who subse- quently enacted legislation allowing the certification of death on 'brain death' criteria in the USA, there seemed to be a worldwide willingness to follow that lead. The concepts of death which the criteria in current use are held to up- hold have been the subject of much philosophical debate, the level of public understanding of which should be a matter of concern.[9] The variety of the di-

[5] D.W.Evans. *The demise of 'brain death' in Britain*, in *Beyond brain death - the case against brain based criteria for human death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, Kluwer Academic Publishers, Dordrecht, 2000. R. Facco, M. Munari M, F. Gall, et al., *Role of short latency evoked potentials in the diagnosis of brain death*, in "Clinical Neurophysiology," 113, 2002, p. 1855- 1866.

[6] D.W. Evans, D.J. Hill, *The brain stems of organ donors are not dead*, in "Catholic Medical Quarterly," 40, 1989, p. 113-121.

[7] R. Hoffenberg, *Christiaan Barnard: his first transplants and their impact on concepts of death*, in "British Medical Journal," 323, 2001, p. 1478-1480. D.W. Evans, *Barnard's first transplants and concepts of death. Response to Hoffenberg*, in "British Medical Journal," 2001: http://bmj.bmjjour- nals.com/cgi/eletters/323/7327/1478#18279. See also responses from Coimbra, Hill, Jarvis, Potts and Woodcock to Hoffenberg's article, on this site.

[8] R.M. Veatch, *Abandon the dead donor rule or change the definition of death?*, in "Kennedy Institute of Ethics Journal," 14, 2004, p. 261-276 (p. 267). See also other articles therein.

[9] *The definition of death*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, Baltimore and London, Johns Hopkins Press, 1999; M. Lock, *Twice dead - organ transplants and the redefinition of death*, University of California Press, London, 2001; *Revisiting brain death*, special issue of the

agnostic criteria[10] belies their ability to identify a discrete clinical entity - or even, with the desirable certainty, a syndrome with an inevitably imminently fatal outcome.

In the UK, equation of 'brain death' (as diagnosed by the 1976 criteria) with death of the person was evidently (in 1979) based on the concept that true and total death of the brain - later modified to "death of the brain as a whole" - self-evidently suffices for the purpose. When the claim that the Code of Practice tests had the power to diagnose the irreversible loss of all brain function became manifestly untenable, Conference's 1995 Working Party "suggested that 'irreversible loss of the capacity for consciousness, combined with irreversible loss of the capacity to breathe' should be re- garded as the definition of death."[11] As a concept of human death, that con- cept might not find wide philosophical acceptance - still less, perhaps, the general public understanding and acceptance which seems necessary in re- gard to so important a matter as human death. But, from the scientific point of view, debate about that aspect must be seen as of little practical relevance in light of Conference's false claim that clinical diagnosis of the syndrome it now calls 'brain stem death' suffices to exclude all possibility of the re- sumption of breathing or consciousness. Their specified apnoea test is not rigorous enough to ascertain the death of the brain stem respiratory centre.[12] Consciousness is not understood. Knowledge of what might be termed the minimal neuroanatomical substrate necessary for its arousal is lacking. There is, therefore, no means at present of testing for remaining life in such elements - still less for the possibility of recovery or regeneration of such el-

"Journal of Medicine and Philosophy," 26, 2001, edited by B.A. Lustig; K.G. Karakatsanis, J.N. Tsanakas, *A critique on the concept of 'brain death'*, in "Issues in Law & Medicine," 18, 2002, p.127-141; R.D.Truog, W.M.Robinson, *Role of brain death and the dead-donor rule in the ethics of organ transplantation*, "Critical Care Medicine," 31, 2003, p. 2391-2396; *Brain death and disorders of consciousness*, edited by C. Machado, D.A. Shewmon, Kluwer Academic/Plenum Publishers, New York, 2004.

[10] *Brain Death*, edited by E.F.M. Wijdicks, Philadelphia, Lippincott Williams & Wilkins, 2001; E.F.M. Wijdicks, *Brain death worldwide: accepted fact but no global consensus in diagnostic criteria*, in "Neurology," 58, 2002, p. 20-25 and in response D.W. Evans, *Open letter to Professor Eelco F.M. Wijdicks, author of book on brain death*, in "British Medical Journal," 2002: http://bmj.bmjjournals.com/cgi/eletters/325/7364/598/a#27760.

[11] Working Group of the Royal College of Physicians, *Criteria for the diagnosis of brain stem death, Review by a Working Group convened by the Royal College of Physicians and endorsed by the Conference of Medical Royal Colleges and their Faculties in the United Kingdom*, p. 381.

ements in brains which are, to all available means of enquiry, silent at the time of testing.

Conclusion

In the present state of knowledge, there is no sound scientific or philosophical basis for the diagnosis of human death on the so-called "brain death" or "brain stem death" clinical criteria in current use worldwide.

Personal Testimony on The Understanding of Brain Death[**]

JOSEPH C. EVERS

I am a pediatrician in full time practice just outside Washington D.C. Fif- teen years ago I was asked to chair a Pediatric Intensive Care Subcommittee at our local hospital in order to revise our existing protocol for diagnosing brain death in children for the purpose of vital organ removal and subsequent transplantation.

This was the first time I was forced to come to grips with the scientific, legal and moral issues surrounding 'brain death'. If I were to approve of a recommendation in the protocol for authorizing organ removal for the pur- poses of organ transplantation, I knew that by my approval, I was saying in effect that I was certain beyond any (reasonable) doubt that a person de- clared, 'brain dead', was in fact dead and that the vital principle (the immor- tal soul) had departed from the body. If this were so, then it was obviously morally permissible to remove vital organs, e.g. the heart from the deceased for the purpose of organ transplantation.

To vote approval while doubt remained would be morally reprehensible on my part for it would mean sanctioning the possible killing of one person for the potential good of another. Regardless of how praiseworthy the end in- tended, the means taken would be in violation of the fifth commandment, "Thou shalt not kill."

To resolve any doubt on the issue I started a literature search and a dia- logue with valued Colleagues. Here I present some of my conclusions. In re- viewing such information on the subject there appeared in the Journal of the

** Presented as written testimony at the Conference on the "Signs of Death," The Pontifical Academy of Sciences, Vatican City, February 3-4, 2005.

American Medical Association an article reporting the case of a 24 year-old pregnant woman, who was declared, "brain dead," on the nineteenth day of her hospitalization. She was then continued on a life-support ventilator for five additional days and just before true death, gave birth by C-section to a healthy 29-week-old baby.[1]

After reading this article I had to ask myself that if this were true would I not also have to say that it was then possible for a "corpse" to nurture her intrauterine baby in the womb and then give birth to a healthy baby several days later. Note well that if she were not pregnant at the time a declaration of brain death was made and granted by the next of kin, her still beating heart could have been legally removed.

Drs. Siegler and Wikler commenting on this said "It becomes irresistible to speak of brain-dead patients being 'somatically alive' (what sort of 'non- somatic' is the alternative?), of being 'terminally ill.' And eventually, of dy- ing? These are different ways of saying that such patients (or, at least their bodies) are alive. The death of the brain seems not to serve as a boundary; it is a tragic, ultimately fatal loss, but not death itself. Bodily death occurs lat- er, when integrated functioning ceases."[2] Most states in the United States presently have brain death statutes. Because of the lack of uniformity in these statutes, the National Conference of Commissioners on Uniform State Laws in collaboration with the American Bar Association and the American Med- ical Association formulated the Uniform Determination of Death Act (UD- DA): "An individual who has sustained either cessation of circulatory and respiratory function, or cessation of all functions of the entire brain, includ- ing the brain stem, is dead. A determination of death must be made in ac- cordance with accepted medical standards."[3]

More than 30 different sets of "brain death" criteria were reported by 1978. There are many more now.

I had to ask myself if one is so positive that all "brain death" criteria de termine 'brain death' why is it necessary to have so many different sets. Some require an electroencephalogram, some do not. For example the Minnesota criteria do not require an electroencephalogram, while the Harvard, Japan-

[1] W.P. Dillon, R.V. Lee, M.J. Tronolone et al., *Life support and maternal brain death during pregnancy*, in "Journal of the American Medical Association," 248, 1982, p. 1089-1091.

[2] M. Siegler, D. Wikler, *Brain death and live birth* (editorial), in "Journal of the American Med ical Association," 248, 1982, p. 1101.

[3] Uniform Determination of Death Act. 12 ULA Civil Proc & Rem Laws-1, 1990.

ese, and Collaborative Study criteria do. In Europe, things are quite differ- ent: England, like Minnesota, does not require an electroencephalogram; in Norway an arteriogram is required. Thus, a patient in one locality could be determined to be dead by one set, but not dead in another locality using an-other set.

Confusion exists in the literature around absence of brain function, func- tions, and functioning of the brain. All of these are used at times inter- changeably with destruction of the brain. During sleep there is loss of some brain functions which recover upon awakening. Narcotics and toxins can re- sult in cessation of many brain functions, which with either normal body me- tabolism or the proper antidote are reversible.

When there is destruction, there is a basic change in structure so that it is no longer what it was before. This change in structure would result not on- ly in no functioning and no function, but also no longer would there be the capacity to function.

It soon became apparent to me that loss of brain function was not equiv- alent to brain destruction, and the very least I could accept, as death of the person was absolute proof of total brain destruction.

My quest for clarity only increased my doubts. A startling study by the National Institute of Neurological and Communicative Disorders and Stroke (NIH Publication No 81 Dec. (1980) greatly disturbed me.[4] In a large study of patients in unresponsive coma and apnea in which the brain specimens were examined for cellular pathology following cardiac arrest, the study found ten percent of the specimens examined showed no cellular destruction and no more that forty percent of them showed cellular destruction through- out the brain. A further study was recommended but has yet to be done.

Physicians involved in making a determination of brain death are re- quired only to establish absence of brain stem reflexes; this is accepted as re- flecting absence of all brain functions. Functions of the brain stem not con- sidered are temperature control, blood pressure, cardiac rate and salt and wa- ter balance. In a patient on a ventilation machine declared 'brain dead', these functions not only are present but also frequently are normal.

Once again I had to ask myself, how is it possible that a patient declared "brain dead" and therefore legally dead, whose brain cellular structure may

[4] *The NINCDS collaborative Study of Brain Death*, NINCDS Monograph No. 24 - National Institute of Neurological and Communicative Disorders and Stroke, US Department of Health and Human Services, NIH Publication No. 81-2286, December 1980.

or may not show microscopic destruction, can be maintained by life support systems just so long, and then the integration systems fail and the person dies? While being maintained, many systems are interdependently function- ing, including the cardiovascular systems, the exocrine and endocrine sys- tems, the excretory systems and the digestive system. In other words, body functions and unity still exist. This unity continues for days, even weeks, then all systems fail and death occurs.

I could avoid the truth no longer, there was either a corpse on the venti- lation machine, or a still living, albeit 'brain dead' person on the machine. If it were a corpse, would you not have to refer to it as a living corpse? But like the square circle, it is a contradiction in terms. You can have one or the oth- er, not both. The conclusion is obvious; a mortally wounded, living person is not equivalent to a dead person. If the declaration of "brain death" becomes the signal to remove the still beating heart, the patient becomes then certainly beyond doubt dead.

To further solidify my reasoning a tragedy occurred to a good friend of mine in that one of her two adult sons was in a near fatal automobile accident and was rushed to the nearest emergency room. The doctors struggled to re- vive him but to no avail and he was pronounced 'brain dead'. As I recall he had been away from the Sacraments of the Church for quite a while but this good woman's other son who was a priest, rushed to his brother's bedside and administered the Sacrament of Anointing of the Sick. Shortly after this sign of God's mercy, life support was discontinued and he breathed his last.

It was not long after this event that the thought occurred to me that sup- pose a request for vital organ transplantation was made after the Anointing. I then asked myself how could this be done? To validly administer and ef- fectively receive this Sacrament there must be the presumption of life. To re- move a vital organ, e.g. the beating heart, he had to be certainly dead. The conclusion was obvious; there is no "litmus" test for the exact moment of the departure of the immortal soul from the body. Neither physician nor theolo- gian can claim it.

I resigned from the protocol subcommittee and voted against the adop- tion of the protocol and then before the entire medical staff told my col- leagues why I had done so and why I wished they would vote against it also. A few did but not enough and the protocol was adopted.

Immediately following this meeting a colleague of mine, a neurologist who I highly respected and who was frequently consulted to make a clinical diagnosis of 'brain death' on a child donor for the purpose of vital organ re-

moval and subsequent transplantation, approached me and said, "You know Joe, you're right; *we just wink at it."*

I co-authored an article on 'brain death' which appeared in the Fall of 1990 in Pharos Medical Journal our conclusions bear repeating:

A human being belongs to the species, *Homo sapiens*, and as such, is a person throughout his entire life, still when dying. There are attributes of a living human that do not belong to other species, e.g. thinking, judging, lov- ing, willing and acting. When it is predicted that the living human being will not be capable of demonstrating these attributes again, the living being does not then belong to another species. He is still a living human person. To say that a patient on a ventilator declared 'brain dead' is a body certain to die and, therefore no longer a person is contrary to reality.

Great care must be taken not to declare a person dead, even a moment before the fact, as the later is a fundamental injustice. A person who is dying is still alive, even a moment before death, and must be treated as such.

In conclusion, we believe there can be destruction of the entire brain, but there has not been found any criteria that have been established to reliably determine this. A cessation of brain function is not the same as destruction. At the present state of the art of medicine, a patient with destruction of the entire brain is, at the most, only mortally wounded, but not yet dead. Death ought not be declared unless there is destruction of the respiratory and cir- culatory system and the entire brain.[5]

[5] P.A. Byrne, J.C. Evers, *Brain Death, Still a Controversy*, "Pharos," 53, 4, 1990, p. 10-12.

The Apnea Test – a Bedside Lethal 'Disaster' to Avoid a Legal 'Disaster' in The Operating Room

CICERO GALLI COIMBRA

I. *Historic Preliminaries*

On December 3rd, 1967, Christiaan Barnard's surgical team carried out the world's first heart transplant at Groote Schuur Hospital in Cape Town, South Africa. Described as "*egocentric, hardworking, clever, ambitious, brash, and somewhat arrogant*," Barnard found in South Africa a permissive envi- ronment, favorable for simply neglecting the traditional and legally accepted cardiopulmonary criteria of death, and outdid leading centers in the United States and Europe. Although the recipient died 18 days later from extensive bilateral pneumonia, the first heart transplantation was acclaimed through- out the world as a major medical conquest, turning Barnard into an interna- tional celebrity. Praised as a near-miracle, Barnard's achievement was most welcomed by the South African government, facing great criticism and the threat of ostracism as a consequence of its inhumane apartheid policy[1].

By the end of the same month, the South African surgical team performed the second heart transplant, after opposing the cautionary search for residual *neurological function* by the donor's physician - Dr. Hoffenberg ("God, Bill, what sort of heart are you going to give us?"). Any misgivings felt by Hof- fenberg (a recognized opponent of the South African government) about de- claring dead a heart-beating person were confounded by the thought that his hesitation might be interpreted as an attempt to undermine the benefit that Barnard's exploits were granting the country's image. Dr. Blaiberg - the sec-

[1] R. Hoffenberg, *Christiaan Barnard: his first transplants and their impact on concepts of death*, in "British Medical Journal," 323, 2001, p. 1478-1480.

ond heart recipient, survived for 18 months along with false propaganda hid- ing his questionable quality of life. Had that second attempt failed, a third heart transplant would have been deferred for years. After Hoffenberg's scrupulous obstruction to an earlier harvest of the second transplanted heart, a clause added to a government banning order immediately stopped him from teaching or entering any educational institution, so that the second donor was the very last patient admitted under his care to Groote Schuur Hospital[2].

In the next month, an *ad hoc* Committee of Harvard faculty (composed of 13 members: 10 physicians-specialties included transplantation, anesthe- siology, neurology and psychiatry, in addition to one theologian, one lawyer, and one historian) rushed to redefine death as 'brain death' in the United States, replacing the traditional criteria of stopped heartbeat and respira- tion[3]. The Harvard Committee completed its work in less than six months, by early June of 1968. In its report (published immediately in an August is- sue of the Journal of the American Medical Association) the Committee (in line with Hoffenberg's methodology) proposed that the state of irreversibil- ity should be diagnosed on purely functional (clinical and electroencephalo- graphic) grounds[4].

The Committee unequivocally acknowledged the removal of legal obsta- cles to the transplant of unpaired vital organs in United States as a major mo- tivation to redefinition of death: "Obsolete criteria for the definition of death can lead to controversy in obtaining organs for transplantation"[5]. Although the committee members stressed that their primary concern was to provide an acceptable mechanism to permit withdrawal of futile life support from "hopelessly unconscious patients," and that the sanction to removal of the heart for transplantation was secondary, a considerable body of evidence points precisely to the inverse order of priorities or even to a negligible im- portance of futile treatment withdrawal for the impetus of redefining death[6].

[3] M. Giacomini, *A Change of Heart and a Change of Mind? Technology and the Redefinition of Death in 1968*, in "Social Science and Medicine," 44, 10, 1997, p. 1465-1482.
[4] Ibid.
[5] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death*, in "Journal of the American Medical Association," 205, 1968, p. 337-340.
[6] M. Giacomini, *A Change of Heart and a Change of Mind? Technology and the Redefinition of Death in 1968*.

All diagnostic versions that have appeared in different countries ever since (including brain-stem death in England by Pallis and co-workers)[7] were quite similar and invariably based on the unproven assumption that irre- versible brain or brain-stem damage would be established when a specific set of brain functions remained clinically undetectable for a few hours. In spite of the evident prognostic rather than diagnostic nature of that assumption[8], the 'brain death' practice further advanced as to be declared a "clinical di- agnosis," implying deeming any confirmatory laboratory test superfluous[9]. In addition, those tests (such as EEG, CT scan, cerebral angiography, etc) have been simply regarded as sources of error as their results could fail to confirm the putatively undeniable clinical diagnosis[10].

II. *How The Clinical "Diagnosis" is no Longer Valid and The "diagnostic" Procedures May Actually Take The Life of Defenseless Comatose Patients*

The reasoning behind the assumed equivalence of inactivation of brain (or brain stem) *functions* and loss of brain *vitality* pertains to the stage of knowledge of clinical neuroscience in 1968. The difference between the arterial and in- tracranial pressures (MAP and ICP respectively) provides the energy required for brain circulation - the so-called "perfusion pressure" (PP, so that PP = MAP- ICP). Therefore, rising of intracranial pressure to or above the systolic arterial pressure leads to intracranial circulatory arrest (complete global ischemia of the brain) and, consequently, to total brain necrosis (infarction of brain tissue) within a short period of time. Until the 1990's, the loss of neurological function during the build-up of intracranial hypertension, usually secondary to progressive edema of the injured brain, was thought to reflect exclusively the completion of global brain ischemia due to equalization of MAP and ICP.
That concept remained firmly 'established' even following the observa- tion of significant residual cerebral blood flow in about 50% of the deeply

[7] C. Pallis, *ABC of Brain Stem Death: Diagnosis of Brain Stem Death - I*, in "British Medical Journal," 285, 1982, p. 1558-1560.
[8] D.A. Shewmon *The probability of inevitability: the inherent impossibility of validating crite ria for brain death or 'irreversibility' through clinical studies,* in "Statistics in Medicine," 6, 1987, p. 535-553.
[9] E.F.M. Wijdicks, *Determining brain death in adults,* in "Neurology," 45, 5, 1995, p. 1003-1011.

comatose patients with absent cephalic reflexes[11], and after the demonstra- tion that deep coma and cephalic areflexia sustained for at least 48 hours were associated with macro and/or microscopic signs of diffuse necrosis in less than 50% of the cases that eventually progressed to cardiac arrest[12]. Ev- idently, 48 hours would have been enough for full development of brain in- farction in 100% of cases if intracranial circulatory arrest were present from the beginning of cephalic areflexia. Necropsy studies like that by Walker et al[13]. only caused the definition of 'brain death' to change from "total de- struction of the brain"[14] to "irreversible loss of brain function," so stipulated without a pathophysiological rationale[15].

However, it is now known that the neural *function* may be only transient- ly suppressed (without loss of nervous tissue vitality) when the blood supply to the brain falls down to levels approximately between 50 to 80% lower than the normal values[16], even if remaining within that range for up to 48 hours[17]. This phenomenon (known as "penumbra" of the nervous tissue, similar to that of the "hibernating" myocardium)[18] is due to a much larger amount of energy production being required for the maintenance of cell function in both tissues, as compared to that necessary for sustaining cell vitality. There- fore, as intracranial hypertension progresses, the brain blood flow cannot reach the lowest values (capable of triggering irreversible damage) without crossing the range of global ischemic penumbra, when some or all neurolog- ical functions may be only transiently undetectable: undoubtedly, that is a

[11] M.N. Shalit, J. Beller, M. Feinsod, et al., *The blood flow and oxygen consumption of the dy ing brain*, in "Neurology," 20, 8, 1970, p. 740-748.

[12] A.E. Walker, E.L. Diamond, J. Moseley, *The neuropathological findings in irreversible co ma*, in "Journal of Neuropathology and Experimental Neurology," 34, 4, 1975, p. 295-323.

[13] Id.

[14] *An Appraisal of the Criteria of Cerebrale Death. A Summary Statement: A Collaborative Study*, in "Journal of the American Medical Association," 237, 1977, p. 982-986.

[15] *Guidelines for the determinaztion of death: report of the medical consultants on the diagno sis of death to the President's Commission for the Study of Ethical Problems in Medicine and Bio- medical and Behavioral Research*, in "Journal of the American Medical Association," 246, 1981, p. 2184-2186.

[16] M. Fisher, *Characterizing the target of acute stroke therapy*, in "Stroke," 28, 1997, p. 866-872.

[17] H. Kalimo, M. Kaste, M. Haltia, *Vascular diseases*, in *Greenfield's Neuropathology*, edited by D.I. Graham and P.L. Lantos, London, Arnold, 1997.

[18] P.G. Camici, W. Wijns, M. Borgers, et al., *Pathophysiological mechanisms of chronic re versible left ventricular dysfunction due to coronary artery disease (hibernating myocardium)*, in "Cir culation," 96, 9, 1997, p. 3205-3214.

physical certainty[19]. Accordingly, as the authors that coined the term "pe- numbra" have pointed out, "This term is descriptive only and may equally well be applied in global ischemia"[20].

Therefore, an unknown percentage of patients with severe intracranial hy- pertension is actually under global ischemic penumbra (therefore still sus- taining the vitality of the brain tissue) by the time when the clinical evaluation for the diagnosis of death based on the status of the neurological functions be- gins[21]. This implies that the recognition of the penumbra phenomenon in the human brain by modern image techniques has invalidated the fundamental premise underlying the clinical diagnosis of 'brain death': as undetectable neu- rological function is not necessarily equivalent to loss of neural vitality, the state of absent cephalic reflexes and deep coma (grade 3 of Glasgow Coma Scale) does not consistently correspond to 'brain death'.

Some residual EEG activity may be conceivably sustained when the brain is supplied with critical circulatory levels (within the upper range of ischemic penumbra). In fact, despite fulfilling the clinical diagnosis of 'brain death', 20% of 56 patients had residual EEG activity that lasted up to 168 hours[22]. Unfor- tunately, the importance of that finding has been consistently disregarded by those authors who have consistently republished guidelines for the diagnosis of 'brain death' without proper attention to the pathophysiology of coma[23].

In addition, since 1968 the "clinical evaluation" for the diagnosis of 'brain death' or 'brain-stem death' has required the transient withdrawal of me- chanical respiratory support, currently for up to 10 minutes in most coun- tries. The objective is to allow the carbon dioxide concentration in the arte- rial blood to rise as to stimulate the respiratory center, thereby testing the most important (as a vital neurologic function) of the cephalic reflexes: the respiratory one. If respiratory movements remain absent [for 10 minutes without measurement of arterial blood gases, or despite the rise in arterial

[19] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death*, in "Brazil ian Journal of Medicine and Biological Research," 32, 12, 1999, p. 1479-1487 (http://www.sci-elo.br/pdf/bjmbr/v32n12/3633m.pdf).

[20] J. Astrup, B.K. Siesjo, L. Symon, *Thresholds in cerebral ischemia - the ischemic penumbra*, in "Stroke," 12, 6, 1981, p. 723-725.

[21] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death.*

[22] M.M. Grigg, M.A. Kelly, G.G. Celesia, et al., *Electroencephalographic activity after brain death*, in "Arch. Neurol.," 44, 9, 1987, p. 948-954.

[23] E.F.M. Wijdicks, *The Diagnosis of Brain Death*, in "New England Journal of Medicine," 344, 16, 2001, p. 1215-1221; E.F.M. Wijdicks, *Determining brain death in adults.*

CO2 partial pressure (augmented PaCO2 or "hypercarbia") to a conven- tionally stipulated target, usually 60 mmHg], the apnea test is said to confirm the diagnosis of death[24]. The stipulated level of hypercarbia varies from one country to another, while the actual threshold required to drive respiratory effort either in adults or children remains unknown, and may vary according to the specific clinical conditions of each case[25].

However, this 'diagnostic' procedure (so-called 'apnea test') may cause ir- reversible damage to brain tissue[26], not only by further increasing intracra- nial pressure (due to enhanced brain swelling)[27], but also (and most impor- tantly) by reducing blood pressure[28]. Inducing hypercarbia in severe brain in- jury is in striking contrast with current recommendation that hypercarbia should be avoided in severe brain injury[29]. Up to 39% of the patients who undergo the apnea test may reach systolic levels lower than 90 mmHg[30]. It is now known that even a very brief episode of hypotension can significantly impair outcome in patients with traumatic brain injury[31]. That both effects associate to decrease the cerebral perfusion pressure is mathematically pre- dictable (PP = MAP-ICP). Previous and/or passive oxygenation measures

[24] E.F.M. Wijdicks, *Determining brain death in adults.*

[25] R. Vardis, M.M. Pollack, *Increased apnea threshold in a pediatric patient with suspected brain death*, in "Critical Care Medicine," 26, 11, 1998, p. 1917-1919.

[26] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death.*

[27] S.J. Dos, A.J. Lande, C.W. Lillehei, *Hypercapnic cerebrospinal fluid hypertension: a phar macological study*, in "Surgery," 63, 5, 1968, p. 788-799.

[28] J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing*, in "Archives of Neurol ogy," 51, 6, 1994, p. 595-599.

[29] P. Carli, G. Orliaguet, *Severe traumatic brain injury in children*, in "Lancet," 363, 2004, p. 584- 585; M.A. Enrione, *Current concepts in the acute management of severe pediatric head trauma*, in "Clin. Ped. Emerg. Medicine," 2,1, 2001, p. 28-40; J. Goh, A.K. Gupta, *The management of head in jury and intracranial pressure*, in "Current Anaesthesia and Critical Care," 13, 3, 2002, p. 129-137.

[30] J.L. Goudreau, E.F. Wijdicks, S.F. Emery, *Complications during apnea testing in the deter mination of brain death: predisposing factors*, in "Neurology," 55, 7, 2000, p. 1045-1048; J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing*; G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diagnosis of brain death*, in "Neurology India," 52, 3, 2004, p. 342-345.

[31] R.M. Chesnut, *Avoidance of hypotension: conditio sine qua non of successful severe head-in jury management*, in "The Journal of Trauma," 42, 5 suppl., 1997, p. 54-59; M.R. Fearnside, R.J. Cook, P. McDougall, et al., *The Westmead Head Injury Project outcome in severe head injury. A comparative analysis of pre-hospital, clinical and CT variables*, in "British Journal of Neurosurgery," 7, 3, 1993, p. 267-279; J. Ghajar, *Traumatic brain injury*, in "Lancet," 356, 2000, p. 923-929; K.H. Polderman, *Application of therapeutic hypothermia in the intensive care unit. Opportunities and pit falls of a promising treatment modality. Part 2: Practical aspects and side effects*, in "Intensive Care Medicine," 30, 5, 2004, p. 757-769.

cannot prevent any of these potentially lethal effects[32] as they are mostly sec- ondary to hypercapnia rather than to hypoxia. In spite of any preventive mea- sure, additional *"major complications"* do occur, including pneumothorax and subcutaneous emphysema, pulmonary hypertension, irreversible cardiac arrest (death), cardiac arrhythmias and cardiac infarction[33].

Due to "an understandable reluctance to publish bad results," the fre- quency of "major complications" during the apnea test may have been un- derestimated[34]. Remarkably, except for Jeret and Benjamin[35], most authors have commented on the possibility of damage inflicted by the apneic insult to transplantable organs, but not on ethical implications of worsening the clinical and neurological conditions of the potential donor or even causing his(her) death. The statements by Bar-Joseph et al.[36] are illustrative: "Chest radiography showed bilateral massive pneumothorax." "The patient's fami- ly consented to organ donation, but the lungs and heart were damaged se- verely and were not harvested for transplantation."

The apnea test may actually induce an irreversible collapse of intracranial circulation rather than only a transient reduction of the brain blood flow, as in- dicated by comparison of clinical data obtained from victims of severe head trauma submitted[37] and not submitted[38] to apnea test. The latter demonstrated

[32] J.L. Goudreau, E.F. Wijdicks, S.F. Emery, *Complications during apnea testing in the deter mination of brain death: predisposing factors*; J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing*; G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diagnosis of brain death*.

[33] G. Bar-Joseph, Y. Bar-Lavie, Z. Zonis, *Tension pneumothorax during apnea testing for the determination of brain death*, in "Anesthesiology," 89, 1998, p. 1250-1251; J.L. Goudreau, E.F. Wi- jdicks, S.F. Emery, *Complications during apnea testing in the determination of brain death: predis posing factors*; J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing*; S.J. Marks, J. Zis- fein, *Apneic oxygenation in apnea tests for brain death. A controlled trial*, in "Arch Neurol," 47, 10, 1990, p. 1066-1068¸ G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diagnosis of brain death*¸ J. Zisfein, S.J. Marks, *Tension pneumothorax and apnea tests*, in "Anesthesiology," 91, 1999, p. 326.

[34] J. Zisfein, S.J. Marks, *Tension pneumothorax and apnea tests.*

[35] J.S. Jeret, J.Benjamin, *In reply to Wijdicks*, in "Arch Neurol," 52, 4, 1995, p. 338-339.

[36] G. Bar-Joseph, Y. Bar-Lavie, Z. Zonis, *Tension pneumothorax during apnea testing for the determination of brain death*.

[37] W.D. Obrist, J.L. Jaggi, T.W. Langfitt, et al., *Cessation of CBF in brain death with normal perfusion pressure*, in "Journal of Cerebral Blood Flow and Metabolism," 1, 1 suppl., 1981, p. S524- S525.

[38] P.B. Balslev-Jørgensen, M.P. Heilbrun, G. Boysen, et al., *Cerebral perfusion pressure corre lated with regional cerebral blood flow, EEG and aortocervical arteriography in patients with severe brain disorders progressing to brain death*, in "European Neurology," 8, 1, 1972, p. 207-212.

that ICP progressively increased to or above the level of mean arterial pressure in all of 10 patients up to spontaneous cardiac arrest. In contrast with that nat- ural history of severe head trauma, Obrist and colleagues[39] found normal levels of intracranial and perfusion pressures in paradoxical association with absent or extremely reduced intracranial blood flow in all 9 heart-beating patients af- ter apnea testing. As the effects of hypotension on the brain blood flow follow- ing severe brain injury suggest[40], apnea testing may normalize the perfusion pressure by inducing a sudden efflux of blood volume from intracranial space

- a vascular collapse turned permanent due to the establishment of tension forces that keep the luminal surfaces of the endothelial cells attached.

Evidently, 'brain death', 'brain-stem death', or death according to the tra- ditional criteria of irreversible cardiac and respiratory arrest might occur as a consequence of apnea testing. Bearing in mind that the test can be of no pos- sible therapeutic benefit to the patient, its use is undoubtedly unethical[41]. Clearly, the diagnosis of brain or brain-stem death is not established when this potentially lethal "test" is performed, and the legal implications of that un- derestimated "complication" or "bad result" cannot be overemphasized. In addition, when the basal ICP is already critically augmented, even a less no- ticeable decrease in blood pressure (to systolic levels not lower than 90 mmHg

- therefore insufficient to discontinue the apnea test, according to The Qual ity Standards Subcommittee of the American Academy of Neurology)[42] may be enough to reduce the blood supply to the respiratory centers as to prevent them from responding to elevations of the arterial concentration of CO2. A minor, usually not registered, further increase in ICP secondary to the hyper- carbic insult may evidently produce similar effects during the apnea test.

Moreover, while an apneic challenge prolonged for about 10 minutes causes hypercarbic acidosis and variable levels of hypotension in a larger number of patients[43], a shorter period of apnea (just long enough to raise the

[39] W.D. Obrist, J.L. Jaggi, T.W. Langfitt, et al., *Cessation of CBF in brain death with normal perfusion pressure*.
[40] J.D. Miller, *Physiology of trauma*, in "Clinical Neurosurgery," 29, 1982, p. 103-130.
[41] D.W. Evans, *Brain death is a recent invention*, in "British Medical Journal," 325, 2002, p. 598.
[42] American Academy of Neurology - Quality Standards Subcommittee, *Practice parameters for determining brain death in adults (Summary statement)*, in "Neurology," 45, 1995, p. 1012- 1014.
[43] J.S. Jeret, *Complications during apnea testing in the determination of brain death: predispos ing factors*, in "Neurology," 56, 9, 2001, p. 1249.

PaCO2 to the commonly stipulated levels of 50-60 mmHg) may only pro- vide a sub-threshold stimulus to the respiratory center in others[44]. In other words, those patients bearing a less robust cardiac condition (with a my- ocardial tissue more sensitive to acidosis) may develop hypotension before reaching the hypercarbic threshold that otherwise (under normo or hyper- tensive conditions) would drive their respiratory effort. Conversely, those with a healthier cardiac function may promptly respond to the apnea-trig- gered catecholamine discharge by developing higher levels of blood and perfusion pressures, occasionally capable of shifting the blood supply to the respiratory centers above the range of ischemic penumbra, thereby showing spontaneous respiratory effort under hypercarbia. Therefore, the apnea test is technically useless for its own intended or declared purpose of character- izing the irreversible loss of respiratory reflex. Because apnea violates the most fundamental guidelines for the management of severe brain injuries by inducing hypercarbia, hypotension and hypoxia[45], it may solely administer the *coup de grace* to a potentially recoverable patient for organ procure- ment[46].
Nevertheless, the apnea test has been regarded as a fundamental step for the diagnosis of 'brain death' since 1968. It is often categorized as "*cardinal*"[47], "*essential*"[48], "*central*"[49], or "*mandatory*"[50]. Without apnea test, no single sign or combination of signs is a reliable *predictor* of death in deeply comatose pa-

[44] R. Vardis, M.M. Pollack, *Increased apnea threshold in a pediatric patient with suspected brain death.*
[45] P.D. Adelson, S.L. Bratton, N.A. Carney, et al.; American Association for Surgery of Trau ma; Child Neurology Society; International Society for Pediatric Neurosurgery; International Trauma Anesthesia and Critical Care Society; Society of Critical Care Medicine; World Federation of Pediatric Intensive and Critical Care Societies, *Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents. Chapter 4. Resuscitation of blood pressure and oxygenation and prehospital brain-specific therapies for the severe pediatric traumatic brain injury patient*, in "Pediatric Critical Care Medicine," 4, 3 suppl., 2003, p. 512-518.
[46] D.J. Hill, *Deception of organ donors. Response to Hoffenberg*, in "British Medical Journal," 2001: http://bmj.bmjjournals.com/cgi/eletters/323/7327/1478#18309.
[47] American Academy of Neurology - Quality Standards Subcommittee, *Practice parameters for determining brain death in adults (Summary statement)*.
[48] G. Bar-Joseph, Y. Bar-Lavie, Z. Zonis, *Tension pneumothorax during apnea testing for the determination of brain death*.
[49] R. Vardis, M.M. Pollack, *Increased apnea threshold in a pediatric patient with suspected brain death.*
[50] G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diag nosis of brain death.*

tients[51]. Therefore, if the assessment of the respiratory reflex is the single critical step for determination (or rather *prediction*) of death, it should not be lethal by any possible mechanism. However, the apnea test is undeniably lethal, by a number of different mechanisms reviewed here.

Then, why not abandon it? In a sequence of publicly exchanged e-mes- sages, Dr. Zisfein[52] was confronted by the physical certainty that an unknown percentage of patients actually have their brains under global is-chemic penumbra when submitted to the apneic insult. On December 23rd, 2000 he clarified the motivation (possibly the main reason) for proceeding with that lethal 'diagnostic' practice: "There is no substitute for the apnea test for 'brain death'. If a patient breathes spontaneously - even if that is the only brain function - he is alive. If an organ donor would begin breathing in the operating room when organs are being recovered, that would be a disaster."

Accordingly, Saposnik et al., from the Department of Organ and Tissue Procurement for Transplantation, Garrahan Hospital, Buenos Aires University, Argentina, unequivocally affirm that the legal implications of killing patients during the apnea test should be ignored:

In our country, as well as in others, the EEG is a legal requirement to determine the diagnosis of 'brain death'. The apnea test is usually performed at the end of the clinical exam and before the EEG. Thus, a cardiac arrest due to a complication dur- ing this procedure has legal implications because the 'brain death' diagnosis has not been established yet. In other words, the patient has to afford the risk of this test be- fore the 'brain death' is declared[53].

Therefore, the term 'disaster' refers to the implications of illegal organ harvesting for the transplant team, rather than to a feeling of consternation for having caused any harm to the donor's health, since even causing his/her death seems to be acceptable behind the curtain of a bedside 'diagnostic' test.

[51] J.J. Caronna, J. Leigh, D. Shaw, et al., *The outcome of medical coma: prediction by bedside assessment of physical signs*, in "Transactions of the American Neurological Association," 100, 1975, p. 25-29.

[52] Dr. Zisfein is: Chief, Section of Neurology; Chair, Ethics Committee; Lincoln Hospital, Brooklyn, NY; e-messages delivered through definingdeath-l@uconnvm.Uconn.Edu.

[53] G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diag nosis of brain death.*

III. *Possibilities of Recovery in Deeply Comatose Patients With Absent Brain Stem Reflexes Who Have Not Been Tested for Apnea*

In 1968 the Harvard Ad Hoc Committee acknowledged that deeply co- matose victims of severe head trauma and accidental hypothermia could re- cover despite presenting clinical and electroencephalographic manifesta- tions of (until then so called) *coma dépassé*[54]. Because the concept of penumbra was first proposed 11 years later[55], recovery from deep coma and absent cephalic reflexes (including the respiratory reflex) secondary to in- tracranial hypertension was unimaginable by 1968. The depressive effect of hypothermia on synaptic function rather than its therapeutic potential was then taken as the only possible explanation for the surprisingly good out- come of accidentally hypothermic victims of severe head trauma. Accord- ingly, hypothermia was simply relegated to the condition of "confounding factor," and ever since 1968 all protocols have obligatorily excluded hy- pothermic patients (core temperature 32ºC) from the diagnosis of brain death[56]. Those who have supported or carried out current 'diagnostic' procedures for brain or brain stem death are now confronted by the evidence that a large percentage (50-70%) of deeply comatose victims of head trauma (Glasgow Coma Scale as low as 3) with absent brain stem reflexes recovered to normal or nearly normal daily life when treated with timely hypothermia instead of being tested for apnea[57]. Watanabe emphasized the implications of recover- ing patients from a neurological condition traditionally deemed hopeless for the credibility of the 'brain death' culture[58]. Additionally, those therapeutic

[54] M. Giacomini, *A Change of Heart and a Change of Mind? Technology and the Redefinition of Death in 1968*.

[55] J. Astrup, B.K. Siesjo, L. Symon, *Thresholds in cerebral ischemia - the ischemic penumbra*.

[56] E.F.M. Wijdicks, *The Diagnosis of Brain Death*; E.F.M. Wijdicks, *Determining brain death in adults*.

[57] N. Hayashi, *Brain hypothermia therapy*, in "Japanese Medical Journal," 3767, 1996, p. 21- 27; N. Hayashi, S. Inao, M. Takayasu, et al., *Effect of early induction of hypothermia on severe head injury*, in "Acta Neurochirurgica. Supplement (Wien)," 81, 2002, p. 83-84; D.W. Marion, W.D. Obrist, P.M. Carlier, et al., *The use of moderate therapeutic hypothermia for patients with severe head injuries: a preliminary report*, in "Journal of Neurosurgery," 79, 3, 1993, p. 354-362; C. Metz,
M. Holzschuh, T. Bein, et al., *Moderate hypothermia in patients with severe head injury and ex- tracerebral effects*, in "J Neurosurg," 85, 4, 1996, p. 533-541.

[58] Y. Watanabe, *Once again on cardiac transplantation. Flaws in the logic of proponents*, in "Japanese Heart Journal," 38, 5, 1997, p. 617-624.

successes now give pragmatic life to Shewmon's forewarning about the inad- equacy of "diagnosing" death on prognostic grounds[59]. Evidently, in contrast to a diagnosis, a prognosis of death can be defeated by improving medical knowledge and therapeutic efficiency.

Mild to moderate therapeutic hypothermia reduces brain edema and swelling, controlling intracranial hypertension refractory to traditional mea- sures[60]. Hence, timely hypothermia may rescue the brain tissue from global ischemic penumbra secondary to those sources of secondary damage[61]. (Fig- ure 3). Therefore, the protective effect of hypothermia in circumstances like severe head trauma may largely arise from its decompressive effect on the brain microvasculature, conceivably being less effective (or even ineffective) when intracranial hypertension is absent and most of the neurologic deficit is due to the primary damage[62].

The viability of the nervous tissue under ischemic penumbra decreases with time[63]. Thus, excessively delayed hypothermia or slow cooling may cause loss of the therapeutic 'window of opportunity' in traumatic brain injury as- sociated with intracranial hypertension. Rebound of intracranial hypertension during rewarming can also decisively affect outcome in the treatment of se- vere head injury[64], and current data indicate that optimal treatment may be achieved if the level of 32-34ºC is achieved within 4 hours of injury, maintained at this temperature for 48-72 hours, followed by warming only if intracranial pressure is less than 20 mmHg and does not rise with gradual rewarming[65].

It should be emphasized, however, that hypothermia is associated with a number of potentially serious side effects, which may counteract some or all of its potential benefits if not properly dealt with. Prevention and/or early

[59] D.A. Shewmon, *The probability of inevitability: the inherent impossibility of validating cri teria for brain death or 'irreversibility' through clinical studies*.

[60] K.H. Polderman, *Application of therapeutic hypothermia in the intensive care unit. Oppor tunities and pitfalls of a promising treatment modality. Part 2: Practical aspects and side effects*; S. Schwab, M. Spranger, A. Aschoff, et al., *Brain temperature monitoring and modulation in patients with severe MCA infarction*, in "Neurology," 48, 3, 1997, p. 762-767.

[61] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death.*

[62] K.H. Polderman, *Application of therapeutic hypothermia in the intensive care unit. Oppor tunities and pitfalls of a promising treatment modality. Part 2: Practical aspects and side effects*.

[63] H. Kalimo, M. Kaste, M. Haltia, *Vascular diseases*, in *Greenfield's Neuropathology*, edited by D.I. Graham and P.L. Lantos.

[64] K.H. Polderman, *Application of therapeutic hypothermia in the intensive care unit. Oppor tunities and pitfalls of a promising treatment modality. Part 2: Practical aspects and side effects*.

[65] F. Shann, *Hypothermia for traumatic brain injury: how soon, how cold, and how long?*, in "Lancet," 362, 2003, p. 1950-1951.

treatment of these complications are the key to successful use of hypother- mia in clinical practice. Accordingly, the failure to demonstrate positive ef- fects of hypothermia in some clinical trials may be partly due to insufficient regard for side effects[66]. Vigilant control of hemodynamic variables is parti- cularly critical, since hypotension and dehydration may impair or even pre- vent the blood flow-mediated brain cooling, allowing the build-up of hyper- thermia of the brain tissue secondary to local inflammatory processes (in- tracranial thermo-pooling)[67]. In other words, systemic hypothermia does not induce effective brain cooling if low blood pressure is sustained. In addition, hypotension may even cause irreversible collapse of the brain circulation in victims of severe head trauma[68], and is clearly the major source of secondary damage in that circumstance[69].

In addition, the lack of careful hyperthermia prevention or inefficient an- tipyresis following the hypothermic treatment may largely enable the re- sumption of the mechanisms of secondary damage initially inhibited by hy- pothermia[70]. Especially following longer periods of hypothermic therapy (which carries a higher risk of hyperthermic complications), poor observance of those imperatives may also lead to dissonant (negative or unchanged) out- come. As properly administered hypothermia for longer than 48 hours is al- so more effective than shorter treatments[71], discrepant results between the

[66] K. Kinoshita, N. Hayashi, A. Sakurai, et al., *Importance of hemodynamics management in pa tients with severe head injury and during hypothermia*, in "Acta Neurochirgica. Supplement," 86, 2003, p. 373-376; K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in trau matic brain injury: effective if properly employed*, in "Critical Care Medicine," 32, 1, 2004, p. 313-314; K.H. Polderman, *Application of therapeutic hypothermia in the ICU: opportunities and pitfalls of a promising treatment modality. Part 1: Indications and evidence*, in "Intensive Care Medicine," 30, 4, 2004, p. 556-575; K.H. Polderman, *Application of therapeutic hypothermia in the intensive care unit. Opportunities and pitfalls of a promising treatment modality. Part 2: Practical aspects and side effects.*

[67] N. Hayashi, S. Inao, M. Takayasu, et al., *Effect of early induction of hypothermia on severe head injury*.

[68] J.D. Miller, *Physiology of trauma*, in "Clin Neurosurg," 29, 1982, p. 103-130.

[69] R.M. Chesnut, *Avoidance of hypotension: conditio sine qua non of successful severe head-in jury management*.

[70] M.N. Diringer, N.L. Reaven, S.E. Funk, et al., *Elevated body temperature independently con tributes to increased length of stay in neurologic intensive care unit patients*, in "Critical Care Medi cine," 32, 7, 2004, p. 1489-1495; E.M. Manno, J.C. Farmer, *Acute brain injury: if hypothermia is good, then is hyperthermia bad?*, in "Critical Care Medicine," 32, 7, 2004, p. 1611-1612; J. Zaremba, *Hy- perthermia in ischemic stroke*, in "Medical Science Monitor," 10, 6, 2004, p. RA148-RA153.

[71] L.A. McIntyre, D.A. Fergusson, P.C. Hebert, et al., *Prolonged therapeutic hypothermia af ter traumatic brain injury in adults: a systematic review*, in "Journal of the American Medical As sociation," 289, 2003, p. 2992-2999.

studies that have and have not included prevention or vigorous treatment of side-effects and complications are expected to occur particularly following prolonged hypothermic paradigms.

Accordingly, Jones et al.[72] found hyperthermia to be another important (second only to hypotension) determinant of poor outcome following head trauma. In a study of patients hospitalized with acute brain insults, 83% of cardiac arrest patients, 70% of those with subarachnoid hemorrhage (SAH), and 68% of those with head injury developed temperature increases within the range reported to worsen neurological outcome (elevations of 1.0ºC or more)[73]. As the authors emphasized, the frequency of these injurious, ran- domly occurring, and traditionally under-treated hyperthermic events have implications for the effectiveness and design of protocols aimed at providing cerebral protection[74]. Therefore, continuous control of hemovolemia and ar- terial pressure may act synergistically with post-rewarming antipyresis to sus- tain the protection provided by mild to moderate hypothermia to the injured brain tissue.

The randomized clinical trial by Clifton et al.[75] - the NABISH-I study - dissonantly failed to demonstrate benefits in the largest number of victims of head trauma so far treated with hypothermia: 392 individuals, with outcome data reported for 368. The NABISH-I is the only study performed in patients with high ICP that reported no benefits on neurological outcome. All other (eleven) randomized clinical trials performed in patients with increased ICP have demonstrated beneficial effects of hypothermia on the outcome of head trauma[76]. A closer look at the NABISH-I protocol reveals that it accepted lower levels of blood and perfusion pressures than previous studies. More- over, episodes of prolonged hypotension (decreasing the perfusion pressure below the aimed protocol parameters for more than 2 hours) occurred more

[72] P.A. Jones, P.J. Andrews, S. Midgley, et al., *Measuring the burden of secondary insults in head-injured patients during intensive care*, in "Journal of Neurosurgical Anesthesiology," 6, 1, 1994, p. 4-14.

[73] R.F. Albrecht, C.T. Wass, W.L. Lanier, *Occurrence of potentially detrimental temperature al terations in hospitalized patients at risk for brain injury*, in "Mayo Clinic Proceedings," 73, 7, 1998, p. 629-635.

[74] Ibid.

[75] G.L. Clifton, E.R. Miller, S.C. Choi, et al., *Lack of effect of induction of hypothermia after acute brain injury*, in "New England Journal of Medicine," 344, 2001, p. 556-563.

[76] L.A. McIntyre, D.A. Fergusson, P.C. Hebert, et al., *Prolonged therapeutic hypothermia af ter traumatic brain injury in adults: a systematic review*; K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in traumatic brain injury: effective if properly employed*.

frequent in the NABISH-I than in other studies on hypothermia in head trau- ma[77]. It is important to keep in mind that even very brief episodes of hy- potension can significantly affect outcome in patients with head trauma[78]. An additional potential problem is that cooling and rewarming was not guided by intracranial pressure in the NABISH-I study; patients were cooled for a period of 48 hours and actively rewarmed afterwards, regardless of the in- tracranial pressure values[79].
As Polderman et al.[80] have emphasized, the conflicting results of 2 meta- analysis of randomized clinical trials on the effects of hypothermia on the out- come of head trauma[81], are probably due to different inclusion criteria adopt- ed by the 2 groups of authors[82].The inclusion of 2 trials on hypothermia in patients without intracranial hypertension[83] in the study by Henderson et al[84]. is in contrast with the methods of McIntyre et al.[85], who included only trials on patients with increased intracranial pressure. Therefore, because the studies by Shiozaki and co-workers did not evaluate the decompressive ef- fect of hypothermia on brain microvasculature, their results do not reflect the

[77] K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in trau matic brain injury: effective if properly employed*.
[78] R.M. Chesnut, *Avoidance of hypotension: conditio sine qua non of successful severe head-in jury management*; M.R. Fearnside, R.J. Cook, P. McDougall, et al., *The Westmead Head Injury Pro ject outcome in severe head injury. A comparative analysis of pre-hospital, clinical and CT variables*;
J. Ghajar, *Traumatic brain injury*; K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *In duced hypothermia in traumatic brain injury: effective if properly employed*.
[79] K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in trau matic brain injury: effective if properly employed*.
[80] Ibid.
[81] W.R. Henderson, V.K. Dhingra, D.R. Chittock, et al., *Hypothermia in the management of traumatic brain injury. A systematic review and meta-analysis*, in "Intensive Care Medicine," 29, 10, 2003, p. 1637-1644; L.A. McIntyre, D.A. Fergusson, P.C. Hebert, et al., *Prolonged therapeutic hy pothermia after traumatic brain injury in adults: a systematic review*.
[82] K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in trau matic brain injury: effective if properly employed*.
[83] T. Shiozaki, T. Hayakata, M. Taneda, et al., *A multicenter prospective randomized controlled trial of the efficacy of mild hypothermia for severely head injured patients with low intracranial pres sure. Mild Hypothermia Study Group in Japan*, in "Journal of Neurosurgery," 94, 1, 2001, p. 50-54;
T. Shiozaki, A. Kato, M. Taneda, et al., *Little benefit from mild hypothermia therapy for severely head injured patients with low intracranial pressure*, in "Journal of Neurosurgery," 91, 2, 1999, p. 185-191.
[84] W.R. Henderson, V.K. Dhingra, D.R. Chittock, et al., *Hypothermia in the management of traumatic brain injury. A systematic review and meta-analysis*.
[85] L.A. McIntyre, D.A. Fergusson, P.C. Hebert, et al., *Prolonged therapeutic hypothermia af ter traumatic brain injury in adults: a systematic review*.

full therapeutic potential of hypothermia in traumatic brain injury[86]. Ac- cordingly, among the 8 articles included in the meta-analysis by Henderson et al.[87], only the 2 studies in patients with normal intracranial pressure have an odds ratio higher than 1 (2.33 and 1.62; odds ratio of the other 6 studies ranged from 0.14 to 0.98; odds ratio higher than 1 indicating harm, odds ra- tio lower than 1 indicating benefit)[88]. In addition, Henderson et al. excluded 11 studies from their meta-analy- sis based on a pre-defined "mathematical" criteria for "randomized clinical trials." Due to the different randomization criteria employed in the relative- ly reduced number of randomized clinical trials available, the rigor of their approach largely reduced the total number of patients ultimately included in their meta-analysis to 748 individuals, and heavily increased the influence of the largest and only study that reported no significant benefit of hy- pothermia in head trauma associated with intracranial hypertension - the NABISH-I study[89]. Excluding those patients with normal intracranial pres- sure (107 individuals), the NABISH-I study of Clifton et al.[90] accounted for more than one-half of the 748 patients with intracranial hypertension in- cluded in the meta-analysis by Henderson et al.[91] Contrastingly, the NABISH-I study accounted for only about one-third of the patients evalu- ated in the review by McIntyre et al.[92], which included 12 studies and 1.069 individual - all of them with intracranial hypertension. More recent data by Clifton et al.[93] demonstrate that hypothermia-on-admission patients as- signed to hypothermia had a lower percentage of poor outcomes than those assigned to normothermia, and inspired the ongoing NABISH-II study ini- tiated in December 2002.

[86] K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in trau matic brain injury: effective if properly employed*.
[87] W.R. Henderson, V.K. Dhingra, D.R. Chittock, et al., *Hypothermia in the management of traumatic brain injury. A systematic review and meta-analysis*.
[88] K.H. Polderman, A.R. van Zanten, M.D. Nipshagen, et al., *Induced hypothermia in trau matic brain injury: effective if properly employed*.
[89] Ibid.
[90] G.L. Clifton, E.R. Miller, S.C. Choi, et al., *Lack of effect of induction of hypothermia after acute brain injury*.
[91] W.R. Henderson, V.K. Dhingra, D.R. Chittock, et al., *Hypothermia in the management of traumatic brain injury. A systematic review and meta-analysis*.
[92] L.A. McIntyre, D.A. Fergusson, P.C. Hebert, et al., *Prolonged therapeutic hypothermia af ter traumatic brain injury in adults: a systematic review*.
[93] G.L. Clifton, E.R. Miller, S.C. Choi, et al., *Hypothermia on admission in patients with se vere brain injury*, in "Journal of Neurotrauma," 19, 3, 2002, p. 293-301.

Taken together, current literature data indicate that properly adminis- tered mild to moderate hypothermia (with sufficient regard for side effects and complications, as well as judicious re-warming according to intracranial pressure responses) may provide strong benefit to patients with severe head trauma and intracranial hypertension[94].

The percentage of good recovery from deep coma (about 50%) associat- ed with dilated pupils, found in aforementioned studies on the effects of ther- apeutic hypothermia following severe head trauma[95] is similar to that of pa- tients in deep coma not submitted to the apnea test found with levels of blood supply within the range of ischemic penumbra. In three studies[96] comprising altogether 12 cases of deep coma and wide pupils, dependent on mechanical ventilation, 6 patients (50%) presented circulatory values ranging from 11.0 to 32.0 ml 100 g-1 min-1, therefore consistent with ischemic penumbra.[97] The electroencephalogram was not flat only in those cases whose levels of cerebral blood flow were in the upper range of ischemic penumbra (25.0 ml 100 g-1 min-1),[98] suggesting that the values encountered did reflect actual levels of blood flow. That percentage (50%) is also similar to that of cases without con- sistent brain necrosis following at least 48 hours of cephalic areflexia without apnea testing.[99] All these data taken together indicate that patients with se- vere intracranial hypertension secondary to brain edema and/or swelling should be treated with mild to moderate hypothermia as early as possible rather than submitted to apnea.

Additionally, mild to moderate hypothermia promote neurological recovery in other categories of patients such as those with global ischemia follow-

[94] K.H. Polderman, E.W. Ely, A.E. Badr, et al., *Induced hypothermia in traumatic brain injury: considering the conflicting results of meta-analyses and moving forward*, in "Intensive Care Medi- cine," 30, 10, 2004, p. 1860-1864.

[95] C. Metz, M. Holzschuh, T. Bein, et al., *Moderate hypothermia in patients with severe head injury and extracerebral effects*, in "Journal of Neurosurgery," 85, 4, 1996, p. 533-541; Y. Watan- abe, *Once again on cardiac transplantation. Flaws in the logic of proponents*.

[96] A. Bes, L. Arbus, Y. Lazorthes, et al., *Hemodynamic and metabolic studies of coma depassé. Research on biological criteria for cerebral death*, in *International Cerebral Blood Flow Symposium, April 1969*, Mainz, Germany; S. Hoyer, J. Wawersik, *Untersuchungen der Hirndurchblutung und des Hirnstoffwechsels beim Decerebrationssyndrom*, in "Langenbecks Archiv für Chirurgie," 322, 1968, p. 602-605; M.N. Shalit, J. Beller, M. Feinsod, et al., *The blood flow and oxygen consumption of the dying brain*, in "Neurology," 20, 8, 1970, p. 740-748.

[97] M. Fisher, *Characterizing the target of acute stroke therapy*.

[98] M.N. Shalit, J. Beller, M. Feinsod, et al., *The blood flow and oxygen consumption of the dy ing brain*.

[99] A.E. Walker, E.L. Diamond, J. Moseley, *The neuropathological findings in irreversible coma*.

ing cardiac arrest[100]. On the basis of supportive evidence from two prospec- tive, randomized, controlled clinical trials[101] the use of mild hypothermia for the treatment of neurologic injury after resuscitation from out-of-hospital car- diac arrest has now been endorsed by the International Liaison Committee on Resuscitation[102]. Watanabe[103] has emphasized the implications of recovering patients in deep coma and fixed-dilated pupils following even more than 30 min of cardiac arrest and reanimation maneuvers for the 'brain death' culture. Associated therapeutic interventions may enlarge the therapeutic window and effectiveness of hypothermia[104]. Iron chelation or depletion is one of the most promising therapeutic co-interventions. Iron released from fer-ritin following acute brain injuries is essential for lipid peroxidation - a powerful mechanism of damage to the cellular membranes, being responsible for tissue edema and cell death. Due to its high lipid content, the nervous tissue is particularly vulnerable to iron-mediated cell damage, and active seques- tration of iron continues to damage the nervous tissue for days to weeks af- ter the primary insult. A larger storage of body iron (as demonstrated by higher ferritin levels) is associated with more severe ischemic damage, while iron chelation reduces ischemic brain injury[105]. Conversely, one of the most im-

[100] S. Bernard, *Hypothermia after cardiac arrest: how to cool and for how long?*, in "Critical Care Medicine," 32, 3, 2004, p. 897-899; S.A. Bernard, *Therapeutic hypothermia after cardiac ar rest. Hypothermia is now standard care for some types of cardiac arrest*, in "Medical Journal of Aus tralia," 181, 9, 2004, p. 468-469; S.A. Bernard, T.W. Gray, M.D. Buist, et al., *Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia*, in "New England Journal of Medicine," 346, 8, 2002, p. 557-563; J. Ghajar, *Traumatic brain injury*; *The Hypothermia After Car diac Arrest Study Group: Mild therapeutic hypothermia to improve the neurological outcome after cardiac arrest*, in "New England Journal of Medicine," 346, 8, 2002, p. 549-556.

[101] S.A. Bernard, T.W. Gray, M.D. Buist, et al., *Treatment of comatose survivors of out-of-hos- pital cardiac arrest with induced hypothermia*; *The Hypothermia After Cardiac Arrest Study Group: Mild therapeutic hypothermia to improve the neurological outcome after cardiac arrest.*

[102] J.P. Nolan, P.T. Morley, T.L. Hoek, et al., *Advancement Life Support Task Force of the In ternational Liaison Committee on Resuscitation. Therapeutic hypothermia after cardiac arrest: An advisory statement by the Advancement Life Support Task Force of the International Liaison Com mittee on Resuscitation*, in "Resuscitation," 57, 2003, p. 231-235.

[103] Y. Watanabe, *Once again on cardiac transplantation. Flaws in the logic of proponents.*

[104] K.H. Polderman, E.W. Ely, A.E. Badr, et al., *Induced hypothermia in traumatic brain in jury: considering the conflicting results of meta-analyses and moving forward*; D.C. Tong, M.A. Yenari, *Combination therapy with hypothermia and pharmaceuticals for the treatment of acute cere bral ischemia*, in *Hypothermia and cerebral ischemia. Mechanisms and clinical applications*, edited by C.M. Maier, G.K. Steinberg, Totowa, NJ, Humana Press, 2004, p. 93-102.

[105] M.H. Selim, R.R. Ratan, *The role of iron neurotoxicity in ischemic stroke*, in "Ageing Re search Reviews," 3, 3, 2004, p. 345-353.

portant mechanisms involved in the hypothermic protection to the nervous tissue is stabilization of cell membranes, thereby reducing brain edema[106]. Therefore, iron chelation during and after the hypothermic treatment may not only synergistically enhance its protective mechanism but also prevent re- bound intracranial hypertension during re-warming.

The combined protective effects of hypothermia and iron depletion on brain and heart tissues may have accounted for the excellent recovery of Anne Green - a 22-year old maid resuscitated to normal life by Thomas Willis (the founder of clinical neuroscience and coiner of the term neurology) and William Petty on December 14, 1650, in Oxford, England[107]. Anne had a miscarriage after four months of pregnancy and was unfairly charged with murder for killing her 'newborn'. Three weeks later, after being hanged for half an hour, during which the sheriff had to stop her relatives from pulling her legs or they would break the rope, her hypothermic 'corpse' was brought to Willis for Anatomy dissections in Oxford. By the time when the coffin was opened to start her dissection at Petty's residence, a strange noise was emitted from her throat and she started to breathe. A contemporary description mentions that Willis and Petty stimulated her throat to provoke coughing, rubbed her arms and legs until she opened her eyes, then bled her of five ounces of blood. Re- warming measures included using heating plasters on her body and placing her into a bed with another woman. She could speak in twelve hours, answer ques- tions in a day, and eat solid food in four days. Her memory recovered over a 2- week period, but the only part of her execution she could recall was seeing her executioner wearing his cloak: "a fellow in a blanket." Within a month she had recovered completely and went on to merry and bear 3 more children[108].

The effects of iron depletion (previous bleeding secondary to her mis- carriage; bloodletting by Willis and Petty) and hypothermia (body exposure to cold environment) may have combined synergistically to protect Anne Green's heart and brain and account for her remarkable recovery.

[106] B. Schaller, R. Graf, *Hypothermia and stroke: the pathophysiological background*, in "Patho- physiology," 10, 1, 2003, p. 7-35.

[107] A.N. Williams, *Thomas Willis' understanding of cerebrovascular disorders*, in "Journal of Stroke and Cerebrovascular Diseases," 12, 6, 2003, p. 280-284.

[108] J.T. Hughes, *Miraculous deliverance of Anne Green: an Oxford case of resuscitation in the seventeenth century*, in "British Medical Journal (Clin. Res. Ed.)," 285 (6357), 1982, p. 1792-1793;
Z. Molnar, *Thomas Willis (1621-1675), the founder of clinical neuroscience*, in "Nature Reviews. Neuroscience," 5, 4, 2004, p. 329-335; A.N. Williams, *Thomas Willis' understanding of cere- brovascular disorders*.

Hypothermia also provides an extraordinary protection to the brain tissue during and following near-drowning. The current record for the longest acci- dental submersion in ice water with an intact neurological outcome - 66 minutes in a 2 1/2-year-old girl in Salt Lake City - was reported in 1988 by Bolte et al[109].

IV. *Additional misconceptions*

A distinctive comment by Shalit et al. on their case # 8 illustrates how loosely the suppression of a specific set of neurological functions has been used in prognostic terms to "determine" death, and demonstrates that a prognosis cannot be used as a diagnosis, for the former is occasionally frustrated:

One of the criteria of 'brain death' is unresponsiveness to external stimuli. Case 8 sheds some doubt on the significance of this criteria. The patient fulfilled all the criteria of 'brain death' for three days and might, therefore, have been accepted as a potential organ donor. Still, on the fourth day, in spite of an isoeletric EEG which was found in two different recordings within a twenty-four-hour interval and in spite of two measurements of CMRO2, which revealed extremely low levels, he began to respond to painful stimuli and thus completely changed his medicolegal status[110].

Even confronted by such a strong evidence against the validation of the criteria by the Harvard Committee in 1968 (cited in their reference list as to assure what they meant by "The patient fulfilled all the criteria of 'brain death' for three days"), the authors simply refused to see what they did not understand or felt uncomfortable about, and conveniently shifted from the concept of 'brain death' (which includes both cerebral and brain stem 'death') to solely cerebral death, while introducing the concept of 'transient' or 'preliminary' as opposed 'final' death:

Presumably, those responses were at a reflectory level only and therefore did not exclude the death of the cerebral hemispheres. On the other hand, the appearance of decerebration close to the patient's 'final' death clearly indicates that the brainstem had

[109] R.G. Bolte, P.G. Black, R.S. Bowers, et al., *The use of extracorporeal rewarming in a child submerged for 66 minutes*, in "Journal of the American Medical Association," 260, 1988, p. 377- 379.
[110] M.N. Shalit, J. Beller, M. Feinsod, et al., *The blood flow and oxygen consumption of the dy ing brain*.

still maintained some of its activity. This could not be detected in our studies since the brain stem is not drained via the jugular vein. Furthermore, regional CMRO2 is not measured in the method used in our study. This fact lead us to the conclusion that some vitality may still be hidden and preserved in deep brain structures at a time when the cerebrum is dead. Therefore, the definition of 'brain death' should perhaps be applied to the death of the cerebrum rather than to the whole central nervous system[111].

Precisely to avoid that 'brain dead' patients could change their 'medicole-gal status', the guardians of 'brain death' culture assume that a variety of bizarre and quite complex limb movements observed during the apnoea test or surgical excision of transplantable organs in some of the patients declared brain dead are mediated at no other part of the CNS but the spinal cord lev-el[112] despite the lack of scientific evidence for that assumption[113]. Disregarding the unavoidable period of global ischemic penumbra during the progression of intracranial hypertension to irreversible damage, they assume that the current neurological criteria for declaration of death reliably identify irreversible loss of brain functions. Hence, because a brain unfailingly diagnosed as dead would not execute synapse-dependent functions, the spinal cord is the only source of motor stimuli left to their consideration, a circular reasoning clearly characterized.
However, in no other clinical circumstance the spinal cord has ever been proposed to independently command such a complex motor activity, involving simultaneous and bilaterally coordinated movements of the upper or lower limbs, neither have the authors ever attempted to describe how and which pathways of the relatively simply synaptic circuitry of the human cord can possibly integrate it. Furthermore, Ropper has contradictorily compared those complex movements to the Moro reflex, a postural reflex present in the first 3 months of life that requires integration at the hindbrain level.
Alan Ropper describes those movements in patients that "fulfilled the clinical and EEG criteria for the diagnosis of 'brain death'" as follows:

The arms flex quickly to the chest from the patient's side, the shoulders adduct, and in some patients, the hands cross or oppose just below the chin. The limbs then return to the patient's side, sometimes asymmetrically. These movements are pre-

[111] Id.
[112] E.F. Wijdicks, *The diagnosis of brain death.*
[113] D.W. Evans, *The ethics of cardiac transplantation*, in "British Journal of Hospital Medi cine," 36, 1, 1986, p. 68-69.

cipitated after several minutes by hypoxia or ischemia when the ventilator is re- moved terminally, or during apnea testing.[114]

Circular reasoning and the lack of scientific evidence (like EEG recording during the observed motor activity) are obvious:

The movements also demonstrate the capacity of agonal spinal cord neurons to produce complex sequential movements, and although movements differ from 'pos- turing,' complex spinal movements need not exclude 'brain death'. Similarly, tho- racic, respiratory-like movements are observed in apnea testing and may still be con- sistent with 'brain death'.[115] Variations included rapid elevation of the arms 10-18 inches off the bed, with the elbows extended in a neutral position as if performing a benediction (one pa- tient) and brief crossing of the hands in front of the neck (one patient) that made the appearance of grasping for the endotracheal tube. One patient had large fascicula- tions in the quadriceps, deltoids and trapezii when the arms reached his chin. One patient made a 3-second forced exhalation as his shoulders adducted just before re- turning the arms on the bed.[116]

The perception of global ischemic penumbra as a physical certainty in cases of coma associate with cephalic areflexia[117] provides an alternative explanation for those complex movements during apnea or organ harvesting. Wetzel et al[118]. demonstrated dramatic increases in systolic and diastolic pressures as well in heart rate after incision in 'brain dead' patients undergoing surgery for organ donation. Increases of up to 90 and 40 mmHg in systolic and diastolic pressures, respectively, and to 50 beats per minute in heart rate were recorded. Those dramatic hemodynamic responses should increase the perfusion pressure, as mathematically predictable (PP = MAP-ICP). Therefore, in a relatively high percentage (about 24%) of the 'brain dead' patients that maintain a residual blood flow through the intracranial arteries into the veins and sinuses[119], the resultant increase in the blood supply to the brain

[114] A.H. Ropper, *Unusual spontaneous movements in brain-dead patients*, p. 1089.
[115] Ibid., p. 1092.
[116] Ibid., p. 1090.
[117] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death*.
[118] R.C. Wetzel, N. Setzer, J.L. Stiff, et al., *Haemodynamic responses in brain dead organ donor patients,* in "Anaesthesia & Analgesia," 64, 2, 1985, p. 125-128.
[119] B. Vlahovitch, P. Frerebeau, A. Kuhner, et al., *Les angiographies sous pression dans la mort du cerveau avec arrêt circulatoire encéphalique*, in "Neurochirurgie," 17, 2, 1971, p. 81-96.

tissue may reach levels above the range of ischemic penumbra, thereby en- abling partial supra-spinal-mediated motor activity in some of them. Thus, those complex movements observed in such agonic circumstances triggering sharp blood pressure elevations (apnea test and surgical removal of organs without anesthesia), may result from abrupt secondary improvements of the cerebral perfusion pressure, leading to transient resumption of fragmentary brain functions. Accordingly, "… clinical and electrical function may turn on and off in the penumbra"[120].

Despite being any confirmatory test now considered 'optional' for the di- agnosis of 'brain death', a 4-vessel angiography is still mandatory in some countries like Sweden[121], and even now required as "the gold standard for the final and definite proof of 'brain death'" whenever CNS-depressing drugs -

e.g. sedatives, barbiturates, opioids - interfere with the clinical evaluation[122]. Whether obligatory or optional, any confirmatory test (including angiogra- phy) is performed after the clinical evaluation for 'brain death', which in- cludes the apnea test[123]. Therefore, because apnea testing may induce in- tracranial vascular collapse, the results of all confirmatory tests carried out thereafter (including angiography and EEG) may reflect the deleterious ef- fects of induced apnea rather than diagnose irreversible brain damage pre- ceding the clinical evaluation.

Even after the detrimental effects of apnea testing on brain circulation, the angiographic analysis still demonstrates delayed filling of the superior longitudinal sinus[124] as well as residual levels of blood flow through the brain arteries into veins and sinuses in about 24% of the 'brain dead' patients[125]. The opacification of cerebral vessels essentially depends on intravascular contrast concentration and blood vessel diameter - variables that are obvi- ously reduced by brain edema, brain swelling and intracranial hypertension. The threshold of blood flow for opacification of intracranial vessels in these

[120] J. Astrup, B.K. Siesjo, L. Symon, *Thresholds in cerebral ischemia - the ischemic penumbra*.

[121] E.F.M. Wijdicks, *The diagnosis of brain death*.

[122] J. Link, M. Schaefer, M. Lang, *Concepts and diagnosis of brain death*, in "Forensic Science International," 69, 3, 1994, p. 195-203.

[123] J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing*; G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diagnosis of brain death*; E.F.M. Wi- jdicks, *The Diagnosis of Brain Death*; E.F.M. Wijdicks, *Determining brain death in adults*.

[124] E.F.M. Wijdicks, *Determining brain death in adults.*

[125] B. Vlahovitch, P. Frerebeau, A. Kuhner, et al., *Les angiographies sous pression dans la mort du cerveau avec arrêt circulatoire encéphalique*.

circumstances has never been determined. In spite of that, some authors have hypothesized that the occurrence of levels of blood flow adequate to sustain tissue but too low to be detected by angiography would be "probably im- possible" on purely theoretical grounds[126]. Therefore, the meaning of angio- graphic data is uncertain for the diagnosis of brain death[127].

Even when the diagnosis of 'brain death' is apparently confirmed fol- lowing apnea testing and cerebral angiography, there is still enough cerebral blood flow to sustain hypothalamic activity as demonstrated by persistent production of 3 different releasing hormones in 24 out of 39 cases within 24 hours after the diagnosis of 'brain death'[128] and sustained thermoregulation. Sustained thermoregulation (core temperature greater than or equal to 36.5ºC during apnea test) - therefore paradoxically considered a prerequi- site for the diagnosis of brain death[129] is clear evidence of preserved hypo- thalamic function and rather suggests that the higher energy-demanding synaptic activity of the remaining brain tissue (cephalic reflexes and respon- siveness) may only be suppressed by ischemic penumbra rather than irre- versibly lost.

Electroencephalography has been ascribed as "one of the most well-vali- dated confirmatory tests"[130] simply because of its sustained adoption "in many countries." However, its sustained and widespread use probably results from low cost and easy implementation, and therefore does not imply scientific val- idation. As brain waves reflect cortical synaptic activity, a flat EEG recording is expected when the brain blood flow is within the range of ischemic penum- bra. The wide use of EEG for the diagnosis of 'brain death' is an example of suppression of brain functions mistaken for loss of brain vitality.

V . *Reactions to technical and ethical criticisms*

Since the publications of the first prospective study on the detrimental ef- fects on apnea test[131] and the critical review on the implications of ischemic

[126] H.H. Kaufman, J. Lynn, *Brain death*, in "Neurosurgery," 19, 5, 1986, p. 850-856.
[127] E.F.M. Wijdicks, *Determining brain death in adults.*
[128] K. Arita, T. Uozumi, S. Oki, et al., *The function of the hypothalamo-pituitary axis in brain dead patients*, in "Acta Neurochirgica (Wien)," 123, 1-2, 1993, p. 64-75.
[129] E.F.M. Wijdicks, *Determining brain death in adults.*
[130] E.F.M. Wijdicks, *The diagnosis of brain death.*
[131] J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing*.

penumbra for the diagnosis of brain death[132], a number of illustrative reactions and silences in response to direct queries regarding the ethical implications and technical issues have been registered. Combining them into a single document may help to realistically depict the present panorama of the highly conflicting interests and motivations surrounding the 'diagnosis' of 'brain death' and harvesting of unpaired vital organs on one side, and the efforts to recover the comatose victim of severe brain injury on the other side. After the publication of Jeret and Benjamin's revealing report, Wijdicks attempted to undermine the importance of the authors' findings by suggesting that poorly administered oxygenation measures could have favored the occurrence of marked hypotension, and only mentioned endangering of organ viability as a "possible reason for fear of performing apnea testing"[133]. Neglecting the main conclusion presented in the authors' original study ("Hypotension can pose a significant risk to patients undergoing apnea testing") where even 2 cases of cardiac arrest were reported[134], Wijdicks stated that "Superficial reading of the article by Jeret and Benjamin may suggest that hypotension during apnea testing is a significant risk, and the report will almost certainly be applauded by skeptics of this procedure"[135]. Nonetheless, Wijdicks did not provide any data to think otherwise and, at the end of his letter, again suggested poor compliance to current guidelines by declaring

Guidelines for apnea testing in 'brain death' are very much needed. Fortunate- ly, differences in the practice of making the diagnosis of 'brain death', in particular the performance of the apnea test, have prompted the Quality Standards Subcom- mittee of the American Academy of Neurology (Minneapolis, Minn) to develop practice parameters for determining 'brain death' in adults[136].

In contrast with the comments by Wijdicks, full compliance to official guidelines were clearly stated in the original paper:

The New York City Health and Hospitals Corporation, which has jurisdiction over our institution, stipulates that the apnea test be performed as follows: ventila-

[132] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death.*
[133] E.F.M. Wijdicks, *In search of a safe apnea test in brain death: is the procedure really more dangerous than we think?*, in "Archives of Neurology," 52, 4, 1995, p. 338.
[134] J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing.*
[135] E.F.M. Wijdicks, *In search of a safe apnea test in brain death: is the procedure really more dangerous than we think?*, p. 338.
[136] Ibid.

tion with 100% oxygen for 10 minutes the ventilator is then withdrawn, followed by passive flow of oxygen through the endotracheal tube or tracheostomy tube. No spontaneous respiration should be noted in these10 minutes. Despite observance of these rigorous criteria and careful monitoring of vital signs, one patient at our insti- tution developed fatal asystole during apnea testing[137].

It should be stressed that "fatal asystole" means precisely death. In addition, the patients that developed marked hypotension during the apneic insult in the study by Jeret and Benjamin had at least the same (if not higher) pre-test concentrations of oxygen in their arterial blood than the normoten-sive patients. In contrast to Wijdicks statements, the apneic methods employed by Jeret and Benjamin were essentially in accordance with those proposed by The Quality Standards Subcommittee of the American Academy of Neurology[138]. The QS Subcommittee actually provided a more detailed description rather than a substantial change to the diagnostic practices in use.

In reply to Wijdicks, Jeret and Benjamin emphasized "the moral impli- cations of performing a potentially dangerous diagnostic test with no therapeutic implications for the patient," affirming that "the legal implications, eg, need for informed consent" were "being explored"[139].

Regarding apnea testing, they reaffirmed that the methods "employed at the State University of New York Health Science Center are rigorous," and ultimately declared: "The legal, ethical, and religious implications of our study await the analysis of experts in these fields."

Later on, Wijdicks co-authored a retrospective study[140] confirming the earlier prospective paper by Jeret and Benjamin regarding the occurrence of severe hypotension in a high percentage of patients during the apnea test, despite the implementation of all preventive measures against hypoxia. In the article by Goudreau et al., the following statements can be read:

Apnea testing in 'brain death' determination may result in cardiovascular com- plications. Hypotension occurred in 24% and cardiac arrhythmias occurred in <1% of the 145 apneic oxygenation procedures.

[137] J.S. Jeret, J.L. Benjamin, *Risk of hypotension during apnea testing.*

[138] American Academy of Neurology - Quality Standards Subcommittee, *Practice parameters for determining brain death in adults (Summary statement)*.

[139] J.S. Jeret, J. Benjamin, *In reply to Wijdicks.*

[140] J.L. Goudreau, E.F. Wijdicks, S.F. Emery, *Complications during apnea testing in the deter mination of brain death: predisposing factors.*

Approximately one in four apnea tests was associated with cardiovascular com- plications, and the rate of complications nearly doubled in tests without adequate precautions. One patient had a cardiac arrest during apnea testing[141].

Prevention of hypotension has been emphasized as the most important measure for optimal intensive care of victims of severe head trauma[142]. Ac- cordingly, it would be reasonable to expect a transparent description of that finding in Wijdicks' latest 'review', so that young physicians in search for state of the art procedures are aware of that frequent hazard. However, when commenting about the safety of apnea test Wijdicks solely cites his own ret- rospective study[143], and clearly implies the results of that paper as completely different from its actual content by declaring:

This method is simple and usually free of complications, provided that adequate precautions are taken. If complications such as hypotension and cardiac arrhythmia occur, they may be due to a failure to provide an adequate source of oxygen or to a lack of preoxygenation[144].

Since the Brazilian protocol for the diagnosis of 'brain death' was approved by the National Medical Council in 1997, there have been several vain attempts to discuss the implications of ischemic penumbra for the validation of those diagnostic steps with those who authored them. Initial attempts included personal communications to one of the authors. To stimulate scientific discussions within the web site of the Federal University of Sao Paulo (UNIFESP), a series of 4 electronic texts became available from the end of 1997 to the first half of 1998[145].

[141] Ibid.

[142] P.D. Adelson, S.L. Bratton, N.A. Carney, et al., *Guidelines for the acute medical manage ment of severe traumatic brain injury in infants, children, and adolescents. Chapter 4. Resuscitation of blood pressure and oxygenation and prehospital brain-specific therapies for the severe pediatric traumatic brain injury patient*; R.M. Chesnut, *Avoidance of hypotension: conditio sine qua non of successful severe head-injury management*; J. Ghajar, *Traumatic brain injury*.

[143] J.L. Goudreau, E.F. Wijdicks, S.F. Emery, *Complications during apnea testing in the deter mination of brain death: predisposing factors*.

[144]Wijdicks E.F.M. *The Diagnosis of Brain Death.* in "New England Journal of Medicine," 2001; 344 (16): 1215-21.

[145] C.G. Coimbra, *Textos sobre morte encefálica (texts on brain death) – 1997-1998*: http://www.unifesp.br/dneuro/textos.htm

This signatory took part in 2 consecutive meetings with all the authors of the Brazilian criteria in January and February 1998 at the Regional Medical Council headquarters (Sao Paulo), when only responses similar to those pre- sented by Dr. Levyman, from the Albert Einstein Jewish Hospital in Sao Paulo, to the "British Medical Journal" on April 7, 2002 were offered[146]. Two lectures on this subject were presented in the UNIFESP campus (to the De- partments of Anesthesiology, and Pediatrics), and 2 others to the Federal University of Rio de Janeiro (UFRJ).

Lectures were also presented in three Brazilian neuroscientific or medical congresses, including a plenary session on *Head Trauma: Brain Death and Or- gan Transplantation in Humans* during the XXIII Annual Brazilian Congress of Neurosurgery on September 2000, when one of the members of the re- gional Medical Council (a pediatric neurologist and one of those who, like Dr. Levyman, co-authored the Brazilian criteria for the diagnosis of 'brain death') simply refused to engage in technical discussions on the basis that there were not enough neurologists or neurosurgeons among the lecturers to address technical issues (there were 4 neurosurgeons among the lecturers, be- sides the whole audience).

A roundtable on this subject was organized during the Annual Congress of the Federation of the Brazilian Societies in August 1998, when Dr. Robert Truog from Harvard University, Boston, also took part in the discussions. A few days later, during a second lecture to an audience of neurologists and neuroscience students of UNIFESP, Dr. Truog suggested that all discus- sions on the implications of ischemic penumbra for the diagnosis of 'brain death' should be postponed until xenotransplantation becomes technically feasible.

In February 2000, the same issue was presented during the Third Inter- national Symposium on Coma and Death, held in Havana, Cuba, and orga- nized by Drs. Alan Shewmon, Calixto Machado and Stuart Youngner.

The editorial board of the journal "Ciência Hoje" ("Science Today," Brazilian Society for the Development of Science - SBpC) invited this signa- tory to write on the same issue[147]. Finally, the paper *Implications of ischemic*

[146] C. Levyman, *Re: Re: Brain stem death - inappropriate interpretation*, in "British Medical Jour nal," Rapid Responses to Inwald et al, 2000. April 7, 2002. http://bmj.bmjjournals.com/cgi/elet- ters/320/7244/1266#20931.

[147] C.G. Coimbra, *Morte encefálica. Falhas nos critérios diagnósticos [Brain death. Flaws of the diagnostic criteria]*, in "Ciencia Hoje," 27, 161, 2000, p. 26-30 (http://www.uol.com.br/cienciaho- je/chmais/pass/ch161/morte.pdf).

penumbra for the diagnosis of 'brain death' was published in the best Brazil- ian medical journal[148], following appropriate peer review.

The subject of that criticism is of supreme importance - the methods and techniques that have been employed for more than 35 years to declare death according to neurological criteria. Accordingly, one reasonably expects that those who still support the traditional practices will explain their position dispassionately. Nevertheless, except for the priceless attitude of a few out- spoken supporters, responses have consistently varied from confidential en- couragement to ostensible retaliation, and typically included recurrent at- tempts to discredit, libel and vilify. Dr. Levyman's not-so-rapid response to "British Medical Journal" is an illustrative example[149].

As a representative of the regional Medical Council in Sao Paulo, Dr. Levyman took part in a live debate in *TV Cultura* of Sao Paulo at the end of December 1997, when he declared that the apnea test is "2- or 3-min long," and if it were 10-min long, "it would be a disaster." In 1997 he had actually co-authored the current duration of up to 10 minutes for the apneic challenge (after pre-oxygenation). In his contribution to "British Medical Journal," he declared that the ischemic insult induced by apnea testing "is not iatrogenic," because 'brain death' is "usually" already established by the time when the current diagnostic steps (including the apnea test) are carried out. That "ir- reversible ischemic neuronal damage occurs before the loss of synaptic ac- tivity" is another of his untenable statements presented in the same contri- bution to "British Medical Journal"[150].

Whenever confronted with the undeniable 'complications' (like death itself) associated with the induction of sudden and profound hypercarbic acidosis dur- ing the apnea test, individuals who defend those 'diagnostic' practices almost in- variably contradict themselves by tagging defenseless deep comatose patients as "already dead" prior to the apnea test, despite having preliminarily recognized apnea as a fundamental neurological criterion for death. In other words, al- though 'brain death' has ever been 'ascertained' upon demonstration that spon- taneous breathing cannot be elicited by the apnea test, defenders of 'brain death' have paradoxically suggested that there would be no problem about causing cardiac arrest or other lethal 'complications' during the apnea test because 'brain death' could be considered certain in advance to the test itself!

[148] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death.*
[149] C. Levyman, *Re: Re: Brain stem death - inappropriate interpretation.*

After receiving the response[151] to his resolute challenge (when the risks of apnea test were simply classified as "Not true!"), Dr Heafield, Consultant Neurologist, Queen Elizabeth Hospital immediately turned silent[152], and re- mained so even after provocatively confronted by the idea that "Medical pro- cedures that do not survive transparent scientific debate cannot be considered standard"[153]. Other contributions to "British Medical Journal" Rapid Re- sponses on this subject have been available, the latest of which since 2002[154].

For almost 8 years, since 1997 when these discussions started in Brazil, during the launch of a massive transplant campaign, not even one single sci- entific argument has ever been presented to refute the proposition that glob- al ischemic penumbra has been mistaken for - and, during the apneic insult, consistently turned into - irreversible brain damage. Instead, the hoped-for discussion has invariably been diverted towards the need to sustain the avail- ability of transplantable organs by preserving the credibility of the trans- plantation system within the medical community and the general public.

One of our University Hospitals (at UNIFESP Campus) is now the world leader in number of kidney transplants per year, having performed 618 of those procedures only in 2004 (more than twice as much as the Alabama Uni- versity – ranked second in the world). Brazilian public hospitals receive about 5,000.00 US dollars for each kidney transplant, while the surgical team gets about 2,000.00 US dollars, all from Brazilian public health system. Private hospitals charges range from 25,000.00 to 50,000.00 US dollars for a kidney transplant, and from 50,000.00 to 300,000.00 US dollars for a liver transplant – medical honorariums not included[155].

[151] C.G. Coimbra, *Global ischaemic penumbra and irreversible loss of brain (or brain stem) function*, in "British Medical Journal" - Rapid Responses to Hoffenberg, 2001. January 17, 2002. http://bmj.bmjjournals.com/cgi/eletters/323/7327/1478#18780.

[152] M.T.E. Heafield, *Brain stem death: inappropriate interpretation*, in "British Medical Journal" - Rapid Responses to Inwald June 12, 2000. http://bmj.bmjjournals.com/cgi/eletters/320/7244/ 1266#8312

[153] C.G. Coimbra, *Medical procedures that do not survive transparent scientific debate cannot be considered standard*, in "British Medical Journal" - Rapid Responses to Inwald, 2000. July 27, 2000. http://bmj.bmjjournals.com/cgi/eletters/320/7244/1266#8964

[154] C.G. Coimbra, *'Brain death' and 'brain stem death'*, in "British Medical Journal" - Rapid Responses to Inwald, 2000. April 29, 2002. http://bmj.bmjjournals.com/cgi/eletters/323/7327/ 1478#18780.

[155] N. Scheper-Hughes, J.G. Biehl, *O fim do corpo. Comércio de órgãos para transplantes cirúr- gicos*, in *Políticas do corpo e o curso da vida*, edited by G.G. Debert, D.M. Goldstein, Sao Paulo, Editora Sumaré, 2000, p. 49-81.

In parallel, there is a gigantic, everlasting advertising campaign devot- ed to convince people to accept organ donation, and to communicate to their family members their wish (before becoming 'brain dead'). From time to time, another desperate patient awaiting organ donation is shown in the media, usually followed by an interview in which a journalist puts questions to transplant surgeons and gets 'didactic' answers. The printed headline "Donate your organs! Save a life!" is emphatically shown in nearly every public place, particularly in public hospitals. In contrast, the families that consent to organ donation never hear about apnea testing. Conversely, pre- ventive educational campaigns dedicated to increase the compliance with effective treatments available for the control of hypertension and diabetes (the 2 leading causes of chronic renal failure, which are highly prevalent and responsible for the vast majority of cases) is almost never carried out (with the transplant campaign judiciously showing only rare causes of re- nal failure), thereby preserving an indefatigable and high demand for trans- plantable organs.

Because the victims of severe head trauma with absent cephalic reflexes are regarded as 'usually dead'[156] and hypothermia is simply considered a "confounding factor" for the diagnosis of 'brain death' (while transplantable organs are so avidly searched for), any attempt to carry out a clinical research project on therapeutic hypothermia (or simply administer hypothermia in ac- cordance with the best parameters currently known) faces enormous obsta- cles in our country. Research grants immediately become unavailable and ICÙs (where even hyperthermia – a major cause of secondary brain damage – is customarily under-treated, despite potentially increasing brain edema by up to 40% within only 2 hours)[157] are declared to lack adequate facilities for hypothermia induction. Providing adequate intensive care treatment is of ex- treme ethical importance, since in many countries the large majority of the patients diagnosed as 'brain death' (therefore 'tested' for apnea) are young adult victims of traumatic head injury. Rough estimates by Brazilian trans- plant surgeons suggest that about 10,000 people are annually diagnosed 'brain dead' in the country.

Furthermore, as an attempt to prevent further public debate on 'sensi- tive' subjects like this, the Brazilian Medical Council changed the national

[156] C. Levyman, *Re: Re: Brain stem death – inappropriate interpretation.*

[157] R.F. Albrecht, C.T. Wass, W.L. Lanier, *Occurrence of potentially detrimental temperature alterations in hospitalized patients at risk for brain injury.*

Code of Medical Ethics, redefining sensationalism by the end of 2003 as "transmission of medical knowledge that may cause public anxiety"[158].

Interestingly enough, the term 'disaster' has been used by 2 different physicians involved in Medical Ethics (Dr. Zisfein from New York, and Dr. Levyman from Sao Paulo) when confronted by the implications of adminis- tering or not the apnea test. In Dr. Zisfein's communication, the term 'disas- ter' refers to the implications of illegal harvesting of vital organs from a breathing donor for the transplant team, rather than to a feeling of conster- nation for causing any harm to the donor's health. In line with that rationale, breaking the law by causing the donor's death behind the curtain of a bed- side 'diagnostic' test is regarded as a necessity by Saposnik and colleagues[159]. However, when the curtain was unexpectedly opened in front of the cameras of TV Cultura during a live transmission in Sao Paulo some years ago, Dr. Levyman appealed to deny the real duration of the 'test', while applying the term 'disaster' to its effect on the donor's survival.

Accordingly, the disregard for informed consent to the apnea test, the "reluctance to publish bad results," the suggestion of postponing discussions on ischemic penumbra until xenotransplantation becomes feasible, and, more recently, the redefinition of sensationalism by the Brazilian Medical Council are all attempts to keep the curtain closed. Keeping it closed, how- ever, will be curtains for the credibility of medical profession.

Mind opening reveals the conspicuous conflict between advanced patho- physiologic concepts and convenient practices of regarding defenseless co- matose patients as mere sources of transplantable organs, submitting them to apnea while misplacing hypothermia as a criterion of exclusion from the di- agnosis of 'brain death'. Rather than producing 'heart beating corpses' suit- able for harvesting transplantable organs, the modern technologies of artifi- cial life support have enlarged the therapeutic window for recovering pa- tients from neurological conditions formerly regarded as hopeless. Labeling patients as 'brain dead' has blinded intensive care physicians to those win- dows of therapeutic opportunity for long enough, and therapeutic hy- pothermia is now progressively taking a prominent position in the treatment of brain damage secondary to severe head trauma and prolonged cardiac ar-

[158] E.O. Andrade, R.S. Silva, RESOLUÇÃO CFM Nº 1.701/2003. http://www.portalmedico.org.br/resolucoes/cfm/2003/1701_2003.htm.

[159] G. Saposnik, G. Rizzo, A. Vega, et al., *Problems associated with the apnea test in the diag- nosis of brain death.*

rest. Approaches to antagonize iron-dependent mechanisms of neuronal damage will probably follow. That would not be possible without techniques like mechanical ventilation.

Despite recognizing that the 'brain dead' is not really dead, some have yet proposed that 'brain death' is as good as death for transplant purposes. How- ever, dying is not death, and too many lives have been lost during the last decades of blindness, when the diagnosis of 'death' has been applied to the silent brain receiving critical levels of blood supply. A patient who would hopelessly die years ago may now be recovered by novel and effective thera- pies developed from improved knowledge on the pathophysiology of coma.

Brain Death. A United Kingdom Anaesthetist's View[**]

DAVID J. HILL

I. *Introduction*

I speak as a clinician and not a philosopher. I am a doctor and an anaes- thetist, having worked for some 42 years in the operating theatre and in pal- liative and intensive care. I was involved in organ transplantation from a very early stage, when organs (corneas, and later kidneys) were removed from ca- davers. I withdrew from the transplantation programme after experience with beating-heart donors, believing first that these patients are not dead in any normally accepted way, and secondly that donors and potential donors are deceived by not being allowed fully informed consent. My concern for and interest in medical ethics led me to establish the Medical Ethics course for clinical medical students at Addenbrooke's Hospital Medical School in Cambridge.

The practice of anaesthesia has changed and developed enormously over the years, but its greatest fascination remains the ability to suspend and then restore animation during surgical procedures. It involves the close observa- tion and monitoring of anaesthetised patients and the responsibility of car- ing for them in that most vulnerable state and then restoring them to con- sciousness and normality. Since the first historic demonstration of anaesthe- sia in 1846, the procedure has been viewed with some awe. How can a per- son be consigned to a state of total (and merciful) insensibility necessitating the taking over of all vital functions, and then completely recover?

** For presentation at the Conference on the "Signs of Death" The Pontifical Academy of Sciences, Vatican City, February 3-4, 2005.

Since those first administrations of anaesthesia, techniques and drugs have developed and improved, allowing even more remarkable liberties to be taken with the human body - techniques such as extra-corporeal circulation, allowing the heart and lungs to be by-passed; profound hypothermia, which reduced the patient to a quasi-cadaveric state for an hour or more; and con- trolled hypotension, whereby blood pressure could be so greatly reduced as to produce virtually no circulation through a part and thus a bloodless field for surgery. Inhalational anaesthesia is being replaced by total intravenous anaesthesia. To be of practical use, all of this must be reversible of course, and it is intriguing to contemplate where the patient is during these some- times lengthy periods of total oblivion? This question is relevant to the idio- syncratic definition of death that was provided by Pallis[1] and which still re- mains the fragile basis for allowing removal of viable organs for transplanta- tion in the United Kingdom.[2] Pallis regarded death (for these purposes) as *the irreversible loss of the capacity for consciousness combined with irreversible loss of the capacity to breathe*.

One of the common observations by patients who have had general anaesthesia – and it may well be the experience of some here – is the lack of any appreciation of the passage of time on recovery from even a very lengthy anaesthetic. During the period of anaesthesia there is loss of both conscious- ness and the ability to breathe. The difference, by Pallis's definition, between that state of anaesthesia and death is that anaesthesia is reversible, but the ir- reversibility, upon which his concept relies, is essentially unobservable. There are occasional reported cases of unexpected recovery from profound coma after many months or even years; how many others may have recovered from death by Pallis's definition, given sufficient time is, of course, speculative.

II. *The History of the Problem*

During the late 1950s there was increasing interest in resuscitation tech- niques, including internal, and later external, cardiac massage and artificial positive pressure ventilation. The development of Intensive Care Units enabled

[1] C. Pallis, D.H. Harley, *The ABC of Brainstem Death*, London, BMJ Publishing Group, 1996, 2nd ed., p. 28.
[2] Working Party on behalf of the Academy of Medical Royal Colleges and the English De partment of Health, *Draft Code of Practice for the Diagnosis and Certification of Death*, May 2006.

the survival of numbers of patients who would otherwise have succumbed, but, as with so many things, this brought its own complications. The most serious of these were those patients who could not be fully resuscitated, remaining to- tally dependent upon life support, and who did not recover either conscious- ness or independence. The difficult decision had sometimes to be made to dis- continue life support which had become a burdensome and apparently futile treatment, and to allow the patient to die. Consultation with family and col- leagues was an essential part of the decision and, to the best of my under- standing, such a decision was ethically and legally, as well as medically, accept- ed. Death would be ascertained and certified in the normal way after total ces- sation of breathing and circulation, i.e. by cardio-pulmonary arrest.

However, in 1976 the Conference of Royal Medical Colleges and their Faculties in the United Kingdom[3] drew up formal conditions and tests *"to es- tablish diagnostic criteria of such rigour that on their fulfilment the mechanical ventilator can be switched off, in the secure knowledge that there is no possible chance of recovery."*

This was a considerable reassurance to know that what had been done before in good faith was now formalised, although it subsequently became clear that that there was already another agenda being prepared for trans- plant purposes. The 1976 paper was deceptively entitled *The Diagnosis of Brain Death*, which it most certainly was not, being neither diagnostic nor establishing death of the whole brain. The terminology was later changed from 'Brain death' to 'Brainstem death',[4] and even more recently referred to in correspondence with the Department of Health as 'Death for Transplant Purposes' and 'Death certified by brainstem testing'.[5] The present *Draft Consultation document of the Working Party on the Diagnosis and Certifica- tion of Death in the UK* favours "death following cessation of brain stem function."[6] The 1976 criteria and tests were prognostic of impending death and, in the United Kingdom, are confined only to partial tests of the brain stem and not of the whole brain, nor is there a requirement for electroen- cephalography (EEG).

[3] Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagno sis of Brain Death*, in British Medical Journal, 2, 1976, p. 1187-1188.

[4] Review by Working Group convened by the Royal Colleges of Physicians and Endorsed by the Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Criteria for the di agnosis of brain stem death*, in "Journal of the Royal College of Physicians," 29, 1995, p. 381-382.

[5] Correspondence with Department of Health, 2001.

[6] *Draft Code of Practice for the Diagnosis and Certification of Death*.

A short 3 years after the original Conference paper, in 1979 (with strong representation from the transplant lobby) the Conference added a Memo- randum[7] to the effect that those very same criteria and tests could be used as diagnostic of death, referring to it as "*the stage at which a patient becomes truly dead, because by then all functions of the brain have permanently and irre- versibly ceased*."
It should be emphasised first that it was widely admitted, even by Pallis,[8] that some functions, or at least some activity, in the higher brain may still per- sist after fulfillment of the brainstem tests; and secondly that the only pur- pose served by declaring a patient to be dead rather than near death, is to provide a legal framework for obtaining viable organs for transplantation. Such a change could in no way be interpreted as of benefit to the dying pa- tient, but only (contrary to Hippocratic principles) of potential benefit to the recipient of that patient's organs. For some of those recipients there can be undoubted medical benefit, in amelioration of symptoms and extension of life. The ends are being used to justify the means, always a most dangerous proposition.
Although the ethics and morality of these changes are clearly question- able, my colleague and friend Dr David Evans (whose assistance in the prepa- ration of this paper I gratefully acknowledge) and I have mainly challenged the fallacies in the science involved, which I will now consider.

III. *Requirements for Organ Transplantation*

There are two essentials for successful organ transplantation, first, viable organs and secondly the prevention of rejection. The second - tissue rejection
- has largely been overcome by the constant improvement of anti-rejection drugs. It is the first - the need for viable organs, taken from living bodies - that gives such trouble and which motivated the change to allow death to be certified in beating heart donors.
After death, and sometimes even before, organs and tissues begin to de- generate. Some, such as corneas, can remain viable for many hours after death determined by cardiopulmonary arrest. Others, such as the heart, lungs

[7] Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagno sis of death*, in "British Medical Journal," 1, 1979, p. 332.
[8] C. Pallis, *Defining death*, in "British Medical Journal," 291, 1985, p. 666-667.

and liver, deteriorate so quickly that they must be obtained from living bod- ies. Yet others, such as kidneys can recover function after an hour or so of what is termed warm ischaemia, that is after the cessation of circulation. Corneas have been used for grafting for many years. There is no urgency to remove them as their viability does not depend upon a blood supply and, al- though the procedure may be seen as macabre, there is not, I believe an eth- ical problem. It is clear to any observer that death has occurred, such that corneas can be removed within twelve to twenty-four hours of cardio-pul- monary death, as part of, or even after, the process of laying out the body. In the early days of kidney (renal) transplantation, the kidneys might be re- moved from a patient who, for instance, had been killed in an accident or who had, in everyone's judgement, no hope of recovery and could have the ventilator switched off. If relatives consented, all life support would be re- moved and the patient be allowed to die. Only then would the body be tak- en to the operating theatre (rather than to the mortuary) and the kidneys would be removed.

The transplantation problem is with the other vital organs - heart, lungs, liver, pancreas, small bowel and so on. Early attempts at using organs, other than corneas and kidneys, taken from cadavers failed because they would not recover from the period of warm ischaemia. The change in death certifica- tion by brainstem testing, allowed in 1979, facilitated heart, lung and liver transplants by enabling the removal of vital organs before life support was turned off, without the risk of legal consequences that might otherwise have attended the practice.

IV. *The Deception*

It is difficult to understand how the public and the profession so readily accepted, and still do, the concept and practice of brainstem death. A very small percentage of doctors have any personal experience of obtaining or transplanting organs and, unusually for a generally independent profession, have accepted the decisions of colleagues, without detailed consideration. Constant re-assurance has been substituted for proper explanation. Media and Government publicity given to organ transplantation has always been emotive and disproportionate. Reputations and departments (and, dare one say, fortunes) have been built upon it. For some patients, organ transplanta- tion seems almost miraculous in its ability to restore a measure of health, but

even failure can be greeted by a fanfare of success. One of the early liver trans- plant children at my hospital, expected to live only a year or two without a transplant, received three liver transplants and then died within the year, and yet this received much favourable publicity. Merely attempting heroic treat- ment can be regarded as a success.

There is a widespread and profound ignorance, even amongst medical staff, of what is actually involved in organ harvesting and they, as do the pub- lic, accept what is done in their name in good faith. It is still not generally re- alised that life support is not withdrawn before organs are taken; nor that some form of anaesthesia is needed to control the donor whilst the operation is being performed. Recently, the experienced Hospital Chaplain at a central London Hospital to whom I was speaking, was astonished and disturbed by that information, of which he was totally unaware.

Before I retired from Addenbrooke's Hospital, I saw records in the Op- erating Department Register that gave the time of death of patients as some hours after the commencement of the operation to harvest organs for trans- plantation. The patients would already have been certified dead following the brainstem tests, but it clearly indicated that the natural opinion of the person (usually a theatre nurse) completing the Register was that the patient re- mained alive until the heart stopped or was removed some hours after the op- eration had commenced. It has been suggested that, because of their role, nurses "may unwittingly promote and foster a definition of death which is fundamentally flawed."[9] There is no statutory definition of death in the Unit- ed Kingdom, but a person is dead when a doctor (or two) say that he is dead. This may be on the more usual cardiopulmonary grounds or following brain-stem testing.

Some of this knowledge may be filtering through to a wider public. The reported refusal rate by relatives for organ removal has risen from 30% in 1992 to 44% recently[10] and in another study[11] only 62% of respondents said that they wished to be kidney donors after their death (even without the ben- efit of an explanation as to how death would be certified). Perhaps it is when relatives are confronted with the evidence of their own eyes, that the poten-

[9] S.D. Edwards, K. Forbes, *Nursing practice and the definition of human death*, in "Nursing Inquiry," 10, 4, 2003, p. 229-235.

[10] C. Rudge, *Organ donation and transplantation*, in "Bulletin of the Royal College of Anaes thetists," 28, 2004, p.1386-1387.

[11] *Kidney donation survey*, ICM Research on behalf of the British Kidney Patients Associa tion, May 2003.

tial donor's body is very much alive, that doubts enter and relatives do not consent to organ harvesting.

Death now is sanitised; very few people in the United Kingdom die at home. But even so most people have had some understanding of death, perhaps in hospital, perhaps only by seeing an animal or pet that has died. Their observation will be what is eloquently described by Shakespeare, when Friar Laurence describes to Juliet how she will appear when apparently dead:

no pulse Shall keep his native progress, but surcease: No warmth, no breath shall testify thou livest; The roses in thy lips and cheeks shall fade To pearly ashes; thy eyes windows fall Like death when he shuts up the day of life; Each part depriv'd of supple government Shall, stiff and stark and pale, appear like death. (Romeo & Juliet Act 4, Scene 1)

This is a world away from the supple, warm, pink, perfused and reactive state that is called death, by brainstem testing of heart-beating donors and which is es- sential for obtaining viable organs for transplantation.

V. *Brainstem Testing*

Brainstem testing involves only simple bedside tests which are carried out by two doctors and repeated once at an unspecified interval. Although these doctors are described as independent of the transplant team, they are only called upon if they are sympathetic to the cause. A doctor who carried out the tests in order to establish that there is no predictable chance of recovery, but would not certify that patient as dead, would not be invited to perform the tests if organs were being sought. This was my experience. Such a patient can, paradoxically, be declared dead by some doctors but not by others.

Accepting the brainstem as the sole indicator of consciousness relies up- on the concept of the reticular activating system in the brainstem. This has no true anatomical identity and has been described as a metaphor.[12] It is believed to arouse the higher brain wherein consciousness is modulated. Con-

[12] M. Roth, Personal communication.

sequently, if it could be established that the brainstem is totally destroyed, there would, by this theory, be no possibility of arousal to consciousness. We have no objective measurement of consciousness, although some steps have been taken in that direction by the use of cerebral monitoring during anaes- thesia, designed to ensure that a patient has no awareness during surgery.

There are two major defects in using brainstem testing as the basis for dis- missing the possibility of the return of consciousness in comatose patients.

First, areas of the higher brain have been identified that have integral cen- tres involved in consciousness, independent of the brainstem.[13] It is widely recognised that parts of the higher brain, including the cerebral cortex, cere- bellum and thalamus (which have a part in consciousness and pain transmis- sion and appreciation), may still be active. In the United Kingdom there is no requirement to look for electroencephalographic (EEG) activity in the high- er brain, which is often present. It is sometimes argued that activity does not necessarily represent function. This may be so, but it may indicate the possi- bility of return of function, as can occur in the heart following treatment for ventricular fibrillation. (The heart muscle is active when fibrillating, but pro- duces no propulsive action. Function may be restored by electrical defibril- lation). Some residual brain functions, particularly involving the hypothala- mus and pituitary gland, can be demonstrated by hormonal changes and any such activity is not compatible with death of the whole brain.

Secondly, the tests for destruction of the brainstem are incomplete. Where, as a result of trauma, there is orbital swelling or aural bleeding pre- venting access for pupillary or labrynthine testing, these tests can be omitted. There is no testing of the vasomotor centres; there is no use of other possible tests such as auditory evoked responses and oesophageal motility.

The respiratory and vasomotor centres reside in the brainstem. The respi- ratory centre is tested by taking the patient off the ventilator to observe whether he breathes spontaneously. The usual stimulus to breathing is by hypercarbia - a rise in carbon dioxide levels. During the period of testing, passive oxygena- tion is maintained. Coimbra has convincingly demonstrated,[14] that this rise in carbon dioxide may cause further damage and even death, as some nerve cells in the ischaemic penumbra which he describes may be inactive but recover-

[13] J.G. Jones, M. Vucevic, *Not awake, not asleep, not dead?*, in "Intensive Care Medicine," 18, 1992, p. 67-68.

[14] C.G. Coimbra, *Implications of ischaemic penumbra for the diagnosis of brain death*, in "Brazilian Journal of Medicine and Biological Research," 32, 12, 1999, p. 1538-1545.

able. The ultimate stimulus to breathing is hypoxia (lack of oxygen) which is not tested for, as it would damage organs required for transplantation. Indeed, as Coimbra has pointed out, it is not ethical to employ a test that is not for the potential benefit of the patient, but rather may prove harmful or lethal. In the 1960s, when ventilators were switched off after patients showed no respiration, I witnessed two occasions (one adult, one child) when, in response to both hy- percarbia and hypoxia, patients resumed breathing.

In 1985, the Working Group of the Pontifical Academy considered the Determination of the Exact Moment of Death. The brainstem tests, as used in the United Kingdom, register the time of death as the time at which the first set of tests is made. This is clearly an arbitrary time as the tests could be done in the morning or the evening or at any other convenient time and can hardly be regarded as factual.

Sometimes death seems to be instantaneous following a catastrophic ac- cident or cardiac arrest, but at other times a period of dying precedes death. Some brainstem tests may be helpful in confirming the dying process, but cannot be diagnostic of death in the presence of continued ventilation and spontaneous heartbeat and circulation. The dying process may be compared with the ebbing tide: the time of lowest tide can be calculated with some ac- curacy, but direct observation at a shore can hardly confirm the exact mo- ment of lowest tide as the waves come and go.

In summary, the brainstem tests employed in the United Kingdom for ob- taining organs for transplantation are based on doubtful science, are incom- plete, and are of potential harm to the patient.

VI. *The Question of* Anaesthesia

The patient in the state described as 'brainstem dead' remains responsive to stimuli and may even show spontaneous movements. There have been re- ports of what is termed the Lazarus phenomenon, where patients who have been certified dead by brainstem tests continue to make seemingly purpose- ful movements.[15] These cause great alarm but are dismissed as purely reflex and terminal, although they are co-ordinated and may well represent cere- bellar and higher brain involvement.

[15] L. Heytens et al., *Lazarus sign and extensor posturing in a brain dead patient*, in "Journal of Neurosurgery," 71, 1989, p. 449-451.

Also dismissed as reflex are the movements and the accompanying rise in pulse rate (tachycardia) and in blood pressure (hypertension) at the begin- ning of and during surgery for the removal of organs, as reported by Wetzel.[16] These responses are regular and predictable and are the same as the re- sponses to surgery of a patient who is too lightly anaesthetised. These re- sponses are normally regarded as being brainstem mediated. There is no ev- idence that they are not, although Wetzel and others maintain, without evi- dence, that they are purely spinal. They should more logically be seen as ev- idence that the brainstem is *not* dead rather than invoking secondary (spinal) mechanisms for what is observed.

It is always necessary to paralyse the beating heart donor in order to pre- vent movement and to make surgery possible, and most (but not all) anaes- thetists give the same general anaesthetic as for any other major operation on a living patient. Others, because of the paradox of anaesthetising a patient al- ready certified as dead, refrain from anaesthesia but control responses by oth- er, non-anaesthetic drugs. Even Pallis and Harley.[17] advocators of brainstem death representing true death, write: "organ donors should receive anaes- thesia in exactly the same way as a sentient patient" and "adequate anaes- thesia should also allay any fears of residual sentience."

There should surely be no need to allay such fears, but they clearly exist in the minds of some anaesthetists and operating theatre personnel as well as patients' relatives. It is not natural to observe so many signs of life in one sup- posed to be dead. As has been observed by others, no pathologist would readily perform a post mortem examination on such a responsive body; no undertaker would bury or cremate one.

VII. *The Question of Consent*

In the United Kingdom there has been unremitting pressure for people to sign and carry a donor card or to join the donor register. This is a form of advance directive and a very suspect document. Currently it is only carried or registered by about 19% of the population, in spite of huge sums spent on publicity. Vehicle registration forms, driving license application forms and

[16] R.C. Wetzel et al., *Haemodynamic responses in brain dead organ donor patients,* in "Anaes thesia & Analgesia," 64, 1985, p. 125-128.

[17] C. Pallis, D.H. Harley, *The ABC of Brainstem Death,* p. 28.

some commercial 'loyalty card' application forms provide 'tick boxes' to reg- ister consent to organ donation and even children are encouraged to sign. These cards carry the statement *"After my death"* with more tick boxes indi- cating which organs may be used, but with no explanation as to the inter- pretation of *"death."* I have yet to meet a lay person and even some doctors who appreciate that life support is not removed before organs are taken, and virtually none who knew that anaesthesia is necessary for the operation. For any other procedure informed consent is required, but for this most final of operations no explanation nor counter-signature is required on the Donor Card nor is the opportunity given to discuss the question of anaesthesia. Per- sonal communication with the Government UK Transplant has failed to elicit a satisfactory response on a number of occasions regarding any guarantee of anaesthesia. It is regarded as good practice for close relatives to be con- sulted and to be given the final agreement but this is not obligatory if. In at least one case the organs were removed even before the patient was identi- fied. This can happen as the legal possession of the body (assuming that the patient is dead) is in the hands of the Hospital if relatives are not available, and consent can then be given by the Chief Administrator.

One wonders whether it is possible to give truly informed consent by rel- atives under conditions of shock, depression, weariness and loss of sleep, and possibly even sedation, when the potential donors have often suffered an un- expected and catastrophic traumatic or cerebral accident. When relevant in- formation, such as the use of anaesthesia, is not given, consent is clearly not informed.

None of this is to belittle the altruistic motives of those who give consent, but rather to question the propriety of the process by which their consent is sought or obtained.

VIII. *And the Future?*

Organ transplantation is unlikely to go away. There are continuing ap- peals and drives to increase the number of donors, but these are driven by emotion and not information.

There has been some progress in the provision of xenografts, that is tissues or organs from animals. The problems of rejection are greater and the british public and the animal rights organisations seem to have more concern for the fate of the animals which might provide organs, than for human donors.

There have been attempts to change the law to allow presumed consent, which would put the onus on people to register objection rather than to give explicit consent. Although this suggestion has the support of the British Medical Association, it has been rejected by Parliament.

A more honest approach is that argued by Truog and Robinson[18] that we should abandon the 'dead donor rule' and all obfuscation, in favour of agree- ment that patients who have no reasonable hope of recovery may be used as a source of organs. This requires acceptance that the removal of organs is *de facto* the ultimate cause of death of the patient with all the legal and ethical problems that would bring, as considered by Potts and Evans.[19]

Some years ago the practice began in the United Kingdom of electively ventilating dying patients, not for their own benefit, but for transference to Intensive Care so that their organs could be kept viable until required for transplantation. This practice, at least, was stopped, being regarded as un- ethical by the British Medical Association.

Our hope is that transparency and honesty will provide the British pub- lic with full information regarding the condition called 'death' on Donor Or- gan consent forms, although the current Working Party Draft Recommen- dations[20] offer no hope of that at present. There should be the requirement for explanation and countersignature as is required for any other medical procedure; and, particularly, the opportunity for discussion on the nature of death, and consent for anaesthesia.

The price of such openness would be a challenge to the pragmatism that regards dying patients as a source of material for treating others and may well result in fewer or no willing beating heart donors, but we should accept that as the price of truth.

Post Scriptum

Since the presentation of this paper, there have been some significant changes in the UK.

[18] R.D. Truog, W.M. Robinson, *Role of brain death and the dead-donor rule in the ethics of or gan transplantation*, in "Critical Care Medicine," 31, 2003, p. 2391-2396.

[19] M. Potts, D.W. Evans, *Does it matter that organ donors are not dead? Ethical and policy im plications*, in "Journal of Medical Ethics," 31, 2005, p. 406-409.

[20] *Draft Code of Practice for the Diagnosis and Certification of Death*.

a) The passage of the *Human Tissue Act* 2006 has removed the right of relatives to modify consent regarding organ donation given by a patient by means of a Donor Card or Register. Such 'consent' to remove organs "after my death" can be made by ticking a box on various unrelated forms (driving licences, loyalty cards etc.) and requires no counter-signature nor explanation of what will be deemed 'death' nor any requirement for anaesthesia. Relatives no longer have the right to remove that consent, however misguided they may later see it to be.

b) A further case is reported of a mother,[21] diagnosed as dead by brainstem testing, maintaining her pregnancy for a further 11 weeks to successful delivery, before her life support was discontinued. This demonstrates again that brainstem testing does not always lead to rapid cardio-pulmonary death as is often claimed and that complex physiology indicative of life can continue to sustain a pregnancy.

c) Functional magnetic resonance investigation (fMRI) has indicated[22] that an unresponsive patient in the persistent vegetative state (PVS) may be able to receive, process and respond and communicate by thought. Although PVS is NOT the same as brainstem death, the fMRI indicates that a PVS patient may not be totally inaccessible and unresponsive as believed, and demonstrates how little we know of the significance of residual brain activity in those diagnosed as dead by brainstem testing.

[21] *Brain dead woman gives birth*, in "British Medical Journal," 332, 2006, p. 1468.
[22] A. Owen, *Detecting awareness in the persistent vegetative state*, in "Science," 313, 2006, p. 1402.

The Beginning and the End of Life. Toward Philosophical Consistency

MICHAEL POTTS

Christian Steineck criticizes the literature supporting 'brain death' for its neglect of philosophy, especially philosophical anthropology and discussions concerning the relationship between mind and body.[1] This is unusual since the debate over 'brain death' "touches directly on what it means to be hu- man."[2] I would add that it touches directly on what it means to be dead or alive, and whether there can be a separation between the human being and the human person. The answers a person presents make a great deal of dif- ference concerning whether a zygote, embryo, or fetus is a living human per- son, or whether a brain-dead individual is a living human person. The impli- cations are vast for both beginning of life issues such as the morality of abor- tion and embryonic stem cell research and also for end of life issues such as when to declare a person dead. Human persons are the bearers of moral rights, including the right to life; thus, if a zygote or a brain dead individual is not a human person, then such an individual does not have a right to life. But if they are human persons, then not only would abortion be wrong, as well as discarding frozen embryos, but so would taking vital organs from 'brain dead' individuals for transplantation purposes.

In this paper, I will defend the position that the human person is a unified soul-body composite in which the soul is the form of the body. Based on that view, I will argue that human personhood cannot be separated from the life of the body. Opposing those such as Mary Ann Warren and Bonnie Steinbock,

[1] C. Steineck, *Brain Death, Philosophical Anthropology and the Body-Mind-Problem* [sic], at http://www.ruhr-uni-bochum.de/kbe/steineck_tsukubapaper.html (accessed April 12, 2004, 1).

who follow John Locke in separating the human organism from the human per- son, I will argue that the two are extensionally equivalent. All human organ- isms who have systemic, integrated, organic functioning are human persons.
Second, I will explore implications of this position for the beginning and end of life. Even if a zygote or embryo is nonsentient, it is a human person, since it is a living human organism. Similarly, a 'brain dead' individual is a liv- ing human organism, and thus a human person, even if some of the powers which express capacities such as reason and feeling cannot be exercised due to damage to or destruction of the brain. Finally, I will discuss and criticize John Lizza's non-Lockean justification of the higher brain criterion for death.

I.

Issues at the edges of life are inevitably interdisciplinary; that is, they in- volve not only scientific matters, but also philosophical and theological ones. Science certainly plays a major role in such issues as abortion and the deter- mination of death, and it would be irresponsible for anyone writing on these subjects to ignore data from the biological and medical fields. However, it would be just as wrong for those in the sciences to ignore the contribution of philosophy and theology to this issue. Limiting the issue of the determination of death to physicians or scientists is just as wrongheaded as leaving it only to philosophers and theologians.[3] I believe that the traditional distinction be- tween the definition, criteria, and tests for declaring death reveals the inter- disciplinary nature of the issue of determining death. The definition of hu- man death depends on one's view of the human person, one's philosophical anthropology, which will in turn fit into an overall metaphysical framework.

[3] In a 1958 address of Pope Pius XII to the International Congress of Anesthesiologists, the Pope said: "It remains for the doctor, and especially the anesthesiologist, to give a clear and pre- cise definition of 'death' and the 'moment of death' of a person who passes away in a state of un- consciousness" (Pope Pius XII, *The Prolongation of Life: An Address of Pope Pius XII to the In- ternational Congress of Anesthesiologists*, in *Death, Dying, and Euthanasia*, edited by D. J. Moran,
D. Hall, Frederick, MD, Aletheia Books, 1980, p. 284-285 [p. 285]). In part, the Pope's address reflects an overly optimistic attitude toward science held by many in the 1950s. His position ef- fectively delimits at least the criterion (here called 'definition') of death to a 'purely' clinical issue, rather than a theological or philosophical one. In my judgment, this view is a mistake, since issues surrounding both birth and death *inevitably* involve philosophical issues, as I argue in the text above.

The criterion for death depends (to some degree) on the definition, and to that extent depends on a prior metaphysical commitment. For example, in general those who hold that the permanent loss of consciousness is the prop- er definition of death prefer the 'higher brain' or 'neocortical' criterion of death. It is only when we reach the level of tests used to confirm a particular criterion for death that we are working at the 'purely' medical/scientific lev- el-but of course the tests are dependent on the criterion which is in turn de- pendent on the definition. It is such dependence on an underlying philo- sophical framework that makes the issue of the declaration of death more than an issue for physicians to decide.

In this section I will set forth a metaphysics of human personhood, a philosophical anthropology, based roughly on Aristotelian-Thomistic princi- ples. Such a view stands in sharp contrast with a position, currently held by some medical ethicists, which is derived in part from Descartes, but whose main influence comes from John Locke. I shall begin with a discussion of this predominately Lockean understanding of human personhood.

One common element among many of the writers who deny both the per- sonhood of the fetus (including the zygote and embryo) and those who are "permanently unconscious" (including the 'brain dead', whether 'whole brain' or 'higher brain') or those who suffer from severe dementia is that they make a sharp distinction between the human being (i.e., human organism) and the human person. Historically, this position is related to Descartes' defining the human person as a "thinking thing," but is more closely related to John Locke's discussion of human personhood in the Essay Concerning Human Understanding. Descartes had argued for a strict soul-body dualism, holding that the soul and the body are two separate substances. The body is merely an unthinking extended substance; the soul is a thinking unextended substance. The human person simply is the soul; in this life the body is "along for the ride" (although soul and body interact in this life).[4] Although Descartes himself did not directly address the status of the permanently un- conscious, it is clear to where the logic of his position leads. Since the human person is identified with the soul, and the soul is identified with conscious- ness, if an individual becomes incapable of conscious experience, then the person is dead. Thus, if the brain, which is necessary for the soul to interact

[4] For Descartes' position see Rene Descartes, *Meditations on First Philosophy* in *The Philo- sophical Works of Descartes*, trans. by E. Haldane and G. Ross, Cambridge, Cambridge University Press, 1931, vol. I, especially Meditations II and III.

with the body, is damaged to the point that there is no consciousness, the per- son is dead (since the soul has separated from the body), even though the body (which is just a machine) may still be alive.

Although, unlike the rationalist Descartes, John Locke was an empiricist, it is remarkable how Cartesian Locke can be, especially in his discussion of the issue of personal identity. His conception of the nature of personhood is a case in point:

"This being premised to find wherein personal Identity consists, we must consider what Person stands for; which, I think, is a thinking intelligent Being, that has reason and reflection, and can consider itself as it self, the same think- ing thing in different times and places; which it does only by that conscious- ness, which is inseparable from thinking, as it seems to me essential to it."[5]

Personal identity is constituted by a continuity of memory over time which is sufficient to show that there has been a continuity of consciousness; as Locke puts it, "as far as this consciousness be extended to any past Action or Thought, so far reaches the Identity of that Person."[6] I am the same person as I was ten years ago because there is a stream of memories going back to that time.

Locke's definition of "self" includes Cartesian elements as well as func- tionalist ones:

"Self is that conscious thinking thing, (whatever Substance, made up of whether Spiritual, or Material, Simple, or Compounded, it matters not) which is sensible, or conscious of Pleasure and Pain, capable of Happiness or Mis- ery, and so is concern'd for it self, as far as that consciousness extends."[7]

Like Descartes, Locke holds that the self is a "thinking thing," with con- sciousness being necessary and sufficient for the identity of the self. Unlike Descartes, who believes that the self is an immaterial substance, Locke be- lieves that his position is compatible either with immaterialism or with a ma- terialist understanding of the generation of consciousness. What is important is that the individual is able to function in a particular way, viz., a continuity of consciousness throughout time (although Locke's theory of personhood should not be confused with the functionalist theory in vogue among current philosophers of mind).[8]

[5] J. Locke, *An Essay Concerning Human Understanding*, edited by P.H. Niddich, Oxford, Clarendon Press, 1975 [1690], Book II, Chapter 27, section 9.

[6] Ibid.

[7] Ibid., Book II, Chapter 27, section 17.

[8] There is one surface similarity between Locke and functionalism, as long as one distinguishes their very different views on what constitutes a mind. For Locke, the mind is constituted by con-

Locke's criterion for someone being the same human being (or human or- ganism) over time differs from his criterion for personal identity. His criteri- on for the identity of the human being is no different from his criterion for plant and non-human animal identity, for identity in all three cases is consti- tuted by continuity of biological life: "… the Identity of the same Man con- sists; viz. In nothing but a participation of the same continued life, by con- stantly fleeting Particles of Matter, in succession vitally united in the same or- ganized Body."[9]

This is in sharp contrast to the continuity of consciousness criterion for the identity of persons. As a thought experiment, Locke supposes that the consciousness of a prince is transferred into the body of a cobbler. In that sit- uation, the body would be the same as the cobbler's, but the personhood would be that of the prince. Since the prince's consciousness is in the cob- bler's body, any deeds done by that individual would bring praise or blame to the prince, not to the cobbler.[10]

For Locke, continuity of memory is the test for continuity of conscious- ness and continuity of consciousness is a necessary and sufficient condition for personal identity. Therefore, if I were to permanently lose my stream of memories,[11] I would lose my personal identity. However, as long as life con- tinued in my body, I would be the same human being. Thus, if any individ- ual were to lose all capacity for consciousness while his or her body still lives, that individual would be dead as a person, but still alive as a human being.

sciousness; for the contemporary functionalist, mental states are such because they have the right causal relations with a larger system. For example, if you have the input of the senses causing par- ticular beliefs or desires which in turn cause a particular behavior [output], then we have a mental state. In most versions of functionalism, 'consciousness' or the qualitative aspects of experience, the 'feel' of experience (often called 'qualia') are not needed to define mental states. On this point, see the discussion in J. Heil, *Philosophy of Mind: A Contemporary Introduction*, London/New York, Routledge, 1998, p. 90-128. Despite these differences, both Locke and the contemporary functionalist would accept the "multiple realizibility thesis," the view that minds can be realized in many different media, whether the media be material (human bodies or ET) or spiritual (again, see Heil on this point).

[9] J. Locke, *Essay*, Book II, chapter 27, section 6.

[10] Ibid., Book II, chapter 27, section 15.

[11] It is unclear how a Lockean (or a Cartesian) might respond to the possibility that there might be stored long-term memories in the brain (or some other medium?) in either patients de clared 'whole brain dead' or patients in a persistent vegetative state. The difficulty of finding em pirical evidence for such memories is a problem; Paul Byrne and his colleagues have suggested an analogy to "the 'ligature' of the power of the soul in ecstasy and some higher forms of mystical union," in which bodily operations are imperceptible to the point that the "person may be thought

This Lockean position, or at least views similar to Locke's, has influenced contemporary bioethics, impacting issues both at the beginning and end of life. Mary Ann Warren is one example. She claims that for a person to exist, an individual must have at least one of the following attributes: conscious- ness, reasoning, self-motivated activity, the capacity to communicate, or the presence of self-concepts and self-awareness.[12] Warren follows Locke in holding that "[s]ome human beings are not people."[13] These include a "man or woman whose consciousness has been permanently obliterated but re- mains alive...; defective human beings, with no appreciable mental capacity...; and a fetus."[14] Such individuals lack "full moral rights."[15]

This metaphysical position on the nature of human personhood has clear implications for issues such as the morality of abortion and the proper crite- ria to be used to declare a person dead. In the case of abortion, it follows from Warren's position that abortion is not equivalent to killing a human person, at least in the early stages of pregnancy (to be very conservative, from the zy- gote stage at least through the early embryo stage before day 20 of gestation when the neural plate forms), since the neural substrate necessary for con- sciousness has not formed at that stage (and thus the zygote or early embryo

dead" (P.A. Byrne, S. O'Reilly, P.M. Quay, at al., *Brain Death: The Patient, the Physician, and So- ciety*, in *Beyond Brain Death: The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, Dordrecht, Kluwer Academic Publishers, 2000, p. 21-89 (p. 53- 54). The chapter was originally published as an article in the "Gonzaga Law Review," 18, 3, 1982- 1983, p. 429-516. They suggest that some kind of communication could take place between the 'brain dead' individual and God. Near death experiences might offer evidence of conscious expe- rience with bodily processes, including brain processes, seem to be in abeyance; see P. van Lom- mel, *About the Continuity of our Consciousness*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 115-132. Although one may doubt the existence of consciousness in PVS or 'brain dead' patients due to lack of behavioral evidence, as Alan Shew- mon notes concerning PVS patients, "'absence of evidence' does not *per se* constitute 'evidence of absence'" (D.A. Shewmon, *The ABC of PVS: Problems of Definition*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 215-226 [p. 220]). Referring to the 'brain dead' patient, David Evans says that "we do not know if… remnants of the personality might still exist somewhere in the brain through which blood still circulates. Since we do not know where, or in what form, it might be, we cannot test for it. We are bound, therefore, to assume its contin- uing presence while any part of the brain remains alive. Ergo, that person/patient is alive" (Per- sonal Communication, January 1, 2005).

[12] M.A. Warren, *On the Moral and Legal Status of Abortion*, in *The Problem of Abortion*, edit ed by J. Feinburg, Belmont, CA, Wadsworth Publishing Company, 1984, 2° ed., p. 111-112.

[13] Ibid., p. 113.

[14] Ibid.

[15] Ibid.

would also be unable to exercise reason).[16] When a fetus (or even a born in- fant) has developed to the point of having the requisite amount of self-con- sciousness needed to qualify for personhood is unclear, but perhaps when the brain has developed sufficiently for self-consciousness to be exercised. On the issue of the determination of death, Lockean positions would tend to support so-called "higher-brain" death; that is, death occurs when the parts of the brain thought to be responsible for conscious awareness permanently cease to function. Individuals in this class would, allegedly, include those in a perma- nent vegetative state as well as anencephalic infants (infants born with "ab- sence of most of the forebrain consisting of frontal, occipital, and parietal cere- bral lobes,"[17] including "lack of development of both cerebral hemispheres and hypothalamus" as well as "an incompletely developed pituitary)."[18] Roland Puccetti accepts this position: "the integrity of the neocortex is essen- tial to the continuance of a mental, and hence a personal life. It follows from this that pallial destruction is equivalent to personal demise. "[19]

[16] The time a developing human being can have conscious experience is a controversial issue, since consciousness is an elusive concept. In the embryo, the neural plate forms after the 20 day mark of de velopment, a crease, called the neural grove quickly forms; its folds join to form the neural tube (at 21 days); other cells form the neural crest. The first neurons form. By 23 days, the initial differentiation of the brain into forebrain, midbrain, and hindbrain occurs. The forebrain (prosencephalon) forms the telencephalon and diencephalon; the former will become the cerebrum. (F.H. Martini, *Fundamentals of Anatomy and Physiology*, Upper Saddle River, NJ, Prentice Hall, 1998, 4° ed., p. 379, 453, 445). In the 4th week there is a rapid expansion of the cerebrum, and the layering of the cortex begins in the 6th week (Ibid., p. 1098). Discernible movement occurs as early as the 6th week of development; the startle response is seen in the 7th week, and much more complicated movements by the 8th week. By this time, the fetus has "a rudimentary information processor, the brainstem reticular formation" (M.J. Flower, *Neuromaturation of the Human Fetus*, in "Journal of Medicine and Philosophy," 10, 1985, p. 237-251 [p. 240]). Flower states that since "all pathways to the neocortex pass through the thalamus, a multicomponent structure which modulates sensory input before relaying it to the cerebrum," de termining the time of such connection is important. He holds that this time is most likely past mid-ges tation (p. 244). He holds that an "eight week fetus is certainly capable of a limited response to stimu lation," but believes that a "proprioceptive sense" is present with a "system-modulating brainstem," which he thinks is present "at 12-14 weeks gestation" (p. 247). But Flower admits that the findings thus far "permit us to make very little headway on the question of fetal sentience" (p. 248). It may be that saying that consciousness is not present in the zygote or early embryo is too conservative a standard, but it is one that should yield considerable agreement, since it is difficult to understand how any sen tience could take place before the formation of the neural plate on day 20 of gestation.

[17] R.C. Cefalo, H.T. Engelhardt, Jr., *The Use of Fetal and Anencephalic Tissue for Transplan tation*, in "Journal of Medicine and Philosophy," 14, 1989, p. 25-43 (p. 28).

[18] Ibid., p. 29.

[19] R. Puccetti, *Does Anyone Survive Neocortical Death*, in *Death: Beyond Whole-Brain Crite ria*, edited by R.M. Zaner, Dordrecht, Kluwer Academic Publishers, 1988, p. 75-90 (p. 87).

I will argue that the Cartesian/Lockean separation between human per- son and human being is incorrect, and that as long as their bodies live, all hu- man beings are human persons. The "standard" Cartesian-Lockean position drives a wedge between the mind and the body, and in more contemporary versions, between the brain and the body, as if human beings are no more than isolated brains. On the contrary, an essential part of human personhood is the fact that humans are embodied persons. Both Cartesian and Lockean views of personhood downplay this fact of experience. On Descartes' ac- count, it is difficult to understand how we could know other minds. Assum- ing Descartes' radically different view of the mind and body, we would not have access to another person's mind, only to his or her behavior. Yet a so- phisticated robot could have the same behavior. How do I know that I am not the only individual in the world with a mind? But if the body, including bodily behavior, is an essential part of human personal identity, there is no such difficulty. Behavior is at least part of the expression of thought, even if not the whole of it, and we can know by behavior that other minds exist.

Locke's "continuity of memory" account of personal identity has grave difficulties as well; an amnesiac would be (literally) a wholly different person than he or she was before. But even people without amnesia forget events in their lives. Even in cases other than complete amnesia, problems remain for the Lockean position. For example, now I can remember some events in my life that took place at the age of two; suppose at age sixty I only remember events back to the age of four. Does this mean that at age 43 I was a person at age two, and at age 60 I was a person only back to age four? This is self- contradictory, since it implies that I was and was not a person at age two.

In addition, a view which identifies the person with memories, con- sciousness, or thoughts runs into the problem noted by David Albert Jones: "If personal identity comprises the identity of conscious attributes (rather than anything 'underlying') then it seems that it can be lost by degrees. A phrase like 'He is not the person he used to be' could be taken literally."[20] Both David Hume[21] and Derek Parfit focus on the fact that thoughts are con- stantly changing, and thus there does not seem to be something we can "pin down" and call a person from time A to time B. Parfit takes this line of

[20] D.A. Jones, O.P., *Metaphysical Misgivings about 'Brain Death'*, in *Beyond Brain Death: The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, Dordrecht, Kluwer Academic Publishers, 2000, p. 91-119 (p. 103).

[21] D. Hume, *A Treatise on Human Nature*, edited by L.A. Selby-Bigge, Oxford, Clarendon Press, 1978, 2° ed., Book I, Section VI.

thought to its logical conclusion, believing that there is no such thing as personal identity, just a series of casually connected "person stages" over time. It follows that if a "person stage" commits a murder in 1985 and a subsequent "person stage" is arrested in 2005, then the later "person stage" should receive little or no punishment.[22]

Besides such absurd consequences, separating the human person from the human organism ignores the fact that human persons are historical beings, with a continuous past and a continuous future, whose history is mediated through their bodies. While human persons may be "more than animals," they are at least animals, and that is part of their nature and history as human persons. To deny this is to espouse an "achievement view" of human personhood, in which individuals must achieve a certain pre-determined ability (e.g., consciousness, reasoning ability) before they can be considered persons. Those unable to actually act as conscious beings do not achieve the norm, and are therefore not persons. This functional view of human personhood is sometimes called 'actualism', for it holds that human beings must actually and immediately have the capacity for conscious experience to be persons.

Despite its difficulties, the Lockean position has great appeal. After all, we do value reason, the memory we have of events in the past, and our self- consciousness. If the capacity for these attributes is totally lost, then one might ask, "What is really left? How could I possibly be a person if I am no longer conscious? If I have no sense of 'I-ness,' no self-awareness whatever, wouldn't it be correct to say that I, or at least what counts about my identity, has been annihilated?." Writers such as Miguel de Unamuno, who believe that annihilation of consciousness at death is worse than eternal suffering in hell,[23] have made this point in a dramatic way. Even the demon Belial, in Milton's Paradise Lost, would rather live in pain than have God annihilate him:

To be no more-sad cure, for who would lose, Though full of
pain, this intellectual being, Those thoughts that wander
through eternity, To perish rather, swallowed up and lost,

[22] D. Parfit, G. Vesey, *Brain Transplants and Personal Identity: A Dialogue*, in *Philosophy: The Quest for Truth*, edited by L.P. Pojman, Belmont, CA, Wadsworth Publishing Company, 2002, 5° ed., p. 296-301. Originally published in G. Vesey, *Philosophy in the Open*, Open University Press, 1974. Parfit's best known work is *Reasons and Persons*, Oxford, Clarendon Press, 1984.

[23] M. de Unamuno, *Tragic Sense of Life*, trans. by J.E. Crawford Flitch, New York, Dover Pub lications, 1954, chapter 3.

In the wide womb of uncreated Night, Devoid of
sense and motion?[24]

Patients with Alzheimer's Disease, who lose their memory, often feel that they are losing themselves, and family members often believe that they are lit- erally losing their loved one over time. Metaphysical systems are judged, not just by their internal coherence, but by their 'fit' with experience, and it seems that the Cartesian/Lockean metaphysics of the human person fits that experience quite well.

Although I am sympathetic to the intuition behind the Cartesian/Lockean view-the wonderful ability of human beings to be self aware is often taken for granted-I do not believe that the Cartesian/Lockean position can successfully overcome the difficulties mentioned earlier. In addition, there is an older alter- native philosophical anthropology which not only avoids the problems (noted above) with the Cartesian/Lockean view, but also has a better fit with experi- ence: the Aristotelian-Thomistic account of human personhood. I will begin with the influential definition of "person" by Boethius: "an individual substance of a rational nature."[25] This definition applies not only to material beings such as human persons, but also to immaterial beings such as God and angels.

How does this definition apply to human personhood? First, the human person is an individual substance. Following here the analysis of J. P. More-land and Scott Rae, a substance, unlike properties such as redness, is 'basic', "not in or had by things more basic than they."[26] Second, a substance, rather than being a propertyless substrate (as Locke believed), has a tight unity in which the parts inhere in the substance. This unity is far more intimate than the unity of a heap of stones or of a machine such as an automobile. A machine is an example of a "property-thing." Property-things are "ordered aggregates or systems of externally related parts," such as automobiles or television sets, whose parts exist prior to the whole, and which interact mechanically, not teleologically.[27] In contrast, the substance is a whole which is

[24] J. Milton, *Paradise Lost and Other Poems*, New York, Mentor Books, 1961, Book II, lines 145-151a.
[25] Boethius, *Contra Eutychen* iii: "*naturae rationabilis individua substantia.*" St. Thomas Aquinas changes the word order slightly when quoting Boethius: "*Persona est rationalis naturae individua substantia*" (St. Thomas Aquinas, *Summa Theologiae*, I, q. 29, art. 1 [Leonine edition]).
[26] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, Downers Grove, IL, InterVarsity Press, 2000, p. 70.
[27] Ibid., p. 78-81.

greater than the sum of the parts, and the identity of the parts of a substance "presupposes the substance as a whole, and those parts are internally related to that whole."[28]

A substance also has an essence or nature "which is the set of essential properties the thing possesses such that it must have this set to be a member of the kind and if it loses any of these essential properties, it ceases to exist."[29] This nature also determines the "lawlike changes" that occur within a sub- stance, as well as how much change it can undergo before ceasing to be the kind of entity it is.[30]

Though space limitations preclude a detailed defense of a substance on- tology, such an ontology makes sense of several aspects of natural objects and natural change. If there were no existing subjects with stability over time with stable dispositions and causal powers, stable ways of acting in the world, then much of our daily lives as well as science itself would be mysterious. The fact that water boils at standard atmospheric pressure at 100° C. is not merely a regularity that gains its legitimacy from our 'custom' or 'habit' of observing water boil, as a Humean would suggest. Rather, water boiling at a particular temperature and pressure is one of the stable dispositions of the substance 'water'. The properties of water differ from the properties of its components, hydrogen and oxygen, by themselves.[31]

Since a living organism is also a substance, it has, as Moreland and Rae note, "new properties true of it as a whole not true of its parts prior to their incorporation into their substances… these new properties would include things like specific kinds of reproduction, assimilation, growth and so forth. Such new properties cannot be accounted for solely by the laws of chemistry and physics, and they are due, in part, to the new nature governing the sub- stance taken as a whole."[32] Plants and animals have a tight internal unity in which the parts are internally related to each other and to the whole, and which function teleologically for the good of the whole. The heart, kidneys, and brain of an animal function for particular purposes (circulating blood, filtering wastes and regulating blood pressure, regulating and fine-tuning

[28] Ibid., p. 71.
[29] Ibid., p. 75.
[30] Ibid., p. 74.
[31] For one defense of this point of view (using sodium chloride as an example), see W.A. Wal lace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis*, Wash ington, DC, The Catholic University of America Press, 1996, p. 57.
[32] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 80.

bodily states as well as helping the animal interact with its environment through emotions, instinct, and in some cases, thought). Internal relations between the parts and whole are shown by the example of the heart; as More- land and Rae note, "The chamber of a heart is what it is in virtue of the role it plays in the heart as a whole; a heart is what it is in virtue of the role it plays in the circulation [sic] system as a whole; the circulation system is what it is in virtue of the role it plays in the organism as a whole."[33] Parts separated from a substance undergo substantial change; "As Aristotle said, a severed human hand is no longer human [except in an equivocal sense, M.P.] because it is no longer a part of the substance that gave it its identity. The severed hand is merely a heap of atoms and other parts, which will become evident in a few weeks."[34] The same is true of other parts of a plant or animal organism; the organism as a whole is primary. A substance ontology, as opposed to an on- tology based only on relations or events, makes better sense of such unity than the alternatives.[35]

The view of personhood that Boethius propounds not only says that per- sons are individual substances, but that they also have "a rational nature." Even though God, angels, and humans are all persons, human beings are an odd group. They share with God and angels the capacity to reason, to com- prehend universals, though in analogous, not univocal, ways. But human be- ings are also animal organisms, which like other organisms, come to be, re- sist entropy for a time, exchange matter and energy with the environment while retaining their identity over time, and then die. Any reasonable account of human personhood must take into account the fact that human persons are "metaphysical amphibians," "rational animals," "neither angels nor apes." A philosophical anthropology which does just that has been set forth by St. Thomas Aquinas and his philosophical heirs.

Important to Aquinas' account of the human being is the notion of the 'soul'. It would be wrong to suggest that Aquinas' notion of the soul is the same as Descartes' notion, since for Descartes the soul, the self-consciousness expressed in thinking, is the human being; the body is a machine which in-

[33] Ibid., 71.

[34] Ibid.

[35] This is not to say that substances are isolated individuals and that relations are not impor tant to substances. W. Norris Clarke has convincingly argued that substances are in act, and there fore will "communicate" to other substances – that is part of their nature as actual entities – and thus, "to be is to be substance-in-relation" (the title of one of Father Clarke's essays in *Explorations in Metaphysics: Being, God, Person*, Notre Dame, IN, University of Notre Dame Press, 1994).

teracts with the soul. For Aquinas, following Aristotle, the soul is integrally tied into the body. He holds that "the human soul is the form of the body" (anima humana corporis forma),[36] and he agrees with Aristotle's statement that "it is unnecessary to ask whether the soul and body are one, just as it is unnecessary to ask whether the wax and its impression are one."[37] For Aquinas, form is the principle of being, of actuality, while matter is the prin- ciple of potentiality. The soul is the name of the form in living things, in- cluding plants and non-human animals, which serves as the principle of life and activity in each organism. The same is true of the human soul. As More- land and Rae put it, "the soul is an individuated essence that makes a body a human body and informs, animates, develops, unifies and grounds the bio- logical functions of the body."[38] Since the soul animates and unifies the en- tire body, not just a particular part of the body, the soul is "in" the whole of the body; as Aquinas puts it, "But since the soul is united to the body as the form, it is necessary that it be in the whole body, and in each part of the body."[39] When the soul separates from the body, the human being as a whole dies, and the corpse is only referred to as a 'human being' in an equivocal sense.[40] Now since the soul grounds the life activities of the body, as long as the human body exists at the level of the organism as a whole, the soul is pre- sent. The soul grounds all the capacities of the human being. Not only does this include the various activities and powers of the body, e.g., internal bod- ily processes such as circulation and digestion, but also the higher capacities of the human being (associated with 'personhood') for reason and moral and religious reflection. Following Moreland and Rae, I call these "ultimate ca- pacities," which "constitute its [the substance's] essence or inner nature, which are possessed solely in virtue of being a member of its natural kind."[41] "Lower order capacities" may be necessary for the expression of ultimate ca- pacities; for example, the brain has to be developed sufficiently (lower order capacity) for a human being to be conscious (ultimate capacity). Ultimate ca-

[36] St. Thomas Aquinas, *Quaestiones de Anima*, art. 1, resp.; see also *Summa Theologica* I, q. 76, art. 1.
[37] *Quaestiones de Anima*, art. 2, sed contra: "*non oportet quaerere si anima et corpus sint unum, sicut neque de cera et figura*."
[38] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 202.
[39] St. Thomas Aquinas, *S. Th.* Part I, question 76, article 8: "*Sed quia anima unitur corpori ut forma, necesse est, quod sit in toto, et in qualibet parte corporis. ..... "*
[40] Ibid.
[41] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 226.

pacities are present as long as the substance exists; in the case of the human being, ultimate capacities, including the capacity for reason, are present as long as the human being is alive. This implies that "being is prior to and the ground of functioning, doing, and relating."[42] Just because a human being lacks certain higher functions due to the lack (due to immaturity of develop- ment) or loss (due to disease or injury) of some of its lower order capacities does not imply that the ultimate capacities have disappeared. "Actualism," the position "which reduces the person to conscious acts or at least to a con- sciously lived center of acts," as Josef Seifert defines it, is not a viable option in an Aristotelian-Thomistic view of personhood; as Seifert continues, com- mending Aristotle for his position, "acts cannot simply arise from nowhere but presuppose a subject that has being in itself, stands in being in himself and not only as inhering in another thing."[43]

Scott Rae makes a helpful distinction between inherent, functional, and social personhood: "Inherent personhood refers to the possession of per- sonhood that comes innately from membership in the human community. Functional personhood refers to the ability to perform the functions that characterize a person, and social personhood refers to recognizing one's rights based on an individual's social utility. The functional and social aspects of personhood are grounded in the inherent."[44]

Membership in the human community is guaranteed by membership in the human species, and a sufficient condition for an individual's membership in the human species is existing as a living bodily being which is a functional whole. Thus, as long as their bodies are alive, human beings always have the ultimate capacity for consciousness and reason, just by being the kind of beings they are. Human personhood, then, is inherent in being a human being: all human be- ings are human persons no matter what their level of development might be and no matter what functional deficits they may have due to illness and/or injury.

Such a metaphysic of the human person makes sense of phenomena diffi- cult to explain on the Cartesian/Lockean account. This metaphysic affirms the

[42] J.P. Moreland, *A Response to Scott B. Rae*, in *Christian Perspectives on Being Human: A Mul- tidisciplinary Approach to Integration*, edited by J.P. Moreland and D.M. Ciocchi, Grand Rapids, MI, Baker Books, 1993, p. 259.

[43] J. Seifert, *Consciousness, Mind, Brain, and Death*, in *Brain Death and Disorders of Con sciousness*, edited by C. Machado and D.A. Shewmon, p. 61-78 (p. 72).

[44] S.B. Rae, *Views of Human Nature at the Edges of Life: Personhood and Medical Ethics*," in *Christian Perspectives on Being Human: A Multidisciplinary Approach to Integration*, edited by J.P. Moreland and D.M. Ciocchi, p. 235-256 (p. 241).

unity of the human person, avoiding the aforementioned difficulties with Cartesian dualism. By affirming the continued existence of the self through the many changes of mind and memory throughout a person's life, it provides a more cogent view of personal identity than the Lockean view. It also makes sense of why the self remains through periods of sleep, anesthesia, and un- consciousness. By accepting the existence of the soul, which grounds the wholeness that is more than the sum of the parts, it avoids the extreme reduc- tionism found in some physicalist views of the human being. It also affirms the value and goodness of human life in all its stages, from conception to death, and in those persons who are unable to reason or be conscious due to severe injury to the underlying physical substrate needed to express such capacities.

II.

An individual's ethics surrounding human life will depend, in part, on his or her metaphysics of human personhood. It is persons who are considered to be bearers of moral rights; if a human individual is not a human person, then the latitude of things which could be done to that individual would con- siderably widen. For example, it might be morally acceptable to experiment on a human being who is not a person, or even kill that individual, especial- ly if such killing could help others. To use a silly example, suppose that some- one believes that in order to be a human person, one must have big feet-say, size 12. The class of nonpersons would include all zygotes, embryos, fetuses, small children, and adults with feet smaller than size 12. Although I would be safe, this class of nonpersons could be used in the ways suggested above without moral fault. Perhaps the embryos could be used for stem cell re- search or those of all ages could be used to harvest organs. Or, to use a more realistic example, suppose one accepts Mary Anne Warren's position and holds that to be a human person, one must be able to express a set of attrib- utes such as consciousness or reason. Then, zygotes, embryos, fetuses, and even small children would be excluded from the class of persons, as well as any individual who is permanently unconscious, or even individuals who are conscious but are suffering from severe dementia. One may disagree with Warren's conclusions, but they are consistent with her metaphysical starting point. Bonnie Steinbock is consistent with her starting position as well, when she argues for the moral rightness of the vast majority of abortions based on her view that only beings with "interests in their own existence" (which she

believes to be beings with sentience) have moral status.[45] These writers should be credited with being consistent with their initial premises. Consis- tency is important, especially among those who count themselves as "pro- life," for real human lives may be at stake.

Many writers who are 'pro-life' on abortion accept the Aristotelian- Thomistic view of human personhood, and I believe that they are correct in doing so. However, when many of these same writers discuss the issue of the determination of human death, their acceptance of 'brain death' criteria is in- consistent with their initial premises. I will discuss the issue of the 'person- hood' status of the zygote, embryo, and fetus, and then move on to a more lengthy discussion of the proper criteria for declaring a person dead.

A number of writers opposing abortion have attacked the Cartesian- Lockean separation of the human being (organism) from the human person. Patrick Lee[46] and Norman Ford both affirm that all human beings are human persons, with Ford saying that as long as the parts of the human organism "contribute to the self-maintenance, self-development, growth, repair, and well-being" of the individual, the human being is alive. Since all human be- ings are human persons, then it also follows that the human person is alive.[47]

For those who accept the Aristotelian-Thomistic view developed above, whether or not the zygote, embryo, or fetus is a person depends on whether it exists at the level of the organism as a whole. If it does, then the soul is in- forming its body. Patrick Lee holds that "fertilization [is] the most reason- able point to place the beginning of the new human individual's life,"[48] ar- guing that the most "natural interpretation of the data" is that "this new or- ganism [the zygote] is the same organism as the one which exists in the womb three weeks later, and then three months later, and so on."[49]

W. Jerome Bracken argues that the early embryo has a wholeness and self-directiveness which implies that it is a new individual organism. Summarizing the biological da- ta, Bracken states: 1) the human zygote contains both the genetic code and its activating molecules for the course of development; 2) methylation [which

[45] B. Steinbock, *Why Most Abortions are not Wrong*, in *Ethical Issues in Modern Medicine*, edited by B. Steinbock, J.D. Arras, A.J. London, Boston, McGraw Hill, 2003, 6° ed., p. 471-482 (p. 472-473).

[46] P. Lee, *Abortion and Unborn Human Life*, Washington, DC, The Catholic University of America Press, 1996, p. 58-60.

[47] N.M. Ford, *When Did I Begin? Conception of the Human Individual in History, Philosophy, and Science*, Cambridge, Cambridge University Press, 1988, p. 95.

[48] P. Lee, *Abortion and Unborn Human Life*, p. 71.

[49] Ibid.

Bracken earlier defined as the process by which "some genes are 'silenced' and other genes are 'turned on' so that development can take place,"[50]] and
3) methylation starts off a cascading effect of shutting genes on and off which continues all during human development.[51]
The point of this is that if the zygote, which is already a living organism, contains the information necessary for its future growth and development as a new individual, this is even further evidence of its being a new person. The situation is similar to an oak seed which has just sprouted; no one could rea- sonably deny that the shoot is a tiny oak tree, a new living individual. Simi- larly, it would be just as absurd to deny that the zygote is a living individual with its unique path of development. As Bracken puts it, "these facts indicate that the individual zygote and its early embryo cells is a person, having a dis- tinct and stable individuality and capable of undergoing development."[52] Moreland and Rae, discussing the fetus, say that it is a human person, not merely part of a woman's body "since the fetus is an organic whole (a sub- stance) that has its own unique identity and nervous and circulatory systems and that as it develops it will appear even more distinct."[53] Thus, since hu- man beings at all stages from zygote to adult are human organisms (and are organized by the human soul, the form of the body), they are also human per- sons whose lives are worthy of protection.
The case for the personhood of the preborn human from conception on- ward seems to me secure; it is clear that a living human organism with its own genetic code is present from the fertilization period onwards. The fact that at least up through the embryo stage the preborn person lacks sentience, con- sciousness, and reason is irrelevant, for it has these capacities just by being a member of the human species. There have been challenges to this position based on the failure of many embryos to implant in the womb, as well as the problem of twinning; space does not permit a discussion of these points, but they have been answered thoroughly in a number of sources.[54]

[50] W.J. Bracken, C.P., *Is the Early Embryo a Person*, in *Life and Learning VIII: Proceedings of the Eighth University Faculty for Life Conference*, edited by J.W. Koterski, S.J., Washington, DC, University Faculty for Life, 1999, p. 443-467 (p. 449).
[51] Ibid., p. 456.
[52] Ibid.
[53] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 241.
[54] For example, in P. Lee, *Abortion and Unborn Human Life*, p. 90-102; W.J. Bracken, C.P., *Is the Early Embryo a Person*, p. 446-453; S. Schwarz, *The Moral Question of Abortion*, Chicago, IL, Loyola University Press, 1990, p. 42-56.

Pro-life writers who have made the case for the personhood of the pre- born human based on an Aristotelian-Thomistic metaphysics are to be com- mended for following through on the implications of their position that even the zygote is a human person. They are also to be commended for making use of recent scientific data on embryology to bolster their case; good science is indispensable in determining which beings are organisms and which ones are not. However, they are not always consistent on the issue of the determina- tion of death.

One point on which they are consistent is their opposition to conscious- ness-based definitions of death and the associated "higher brain" criterion. Moreland and Rae, for example, strongly support the full personhood of PVS patients.[55] They oppose those, such as James Rachels, who make a sharp dis- tinction (in Lockean fashion) between human biological life and human per- sonal life, holding that consciousness and awareness are necessary conditions for biographical life. Thus, for Rachels, a permanently unconscious patient has lost his or her biographical life, but retains biological life. Killing those who lack biographical life would be morally acceptable, since it is biograph- ical life that grounds human moral worth.[56] Moreland and Rae argue that such neo-Lockeans put the cart before the horse: "The capacity to have a bi- ographical life-far from rendering biological life irrelevant-actually presup- poses it. Thus, a person's biographical life is grounded in his or her biologi- cal life by virtue of being a particular kind, a human being."[57] A PVS patient has lost the ability to express his or her first-order capacities. However, "Sim- ply because those capacities can no longer be expressed, it does not follow that the essence in which they are grounded has also been lost. Personhood is not lost when the ability to express the capacities is lost."[58]

Moreland and Rae ask if a PVS patient is dead as a person, whether that implies that it is acceptable to bury that individual, remove organs, or per- form medical experiments on him or her? Most people would consider such actions morally repugnant, but how could they be such if the person is truly

[55] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 319. They deny that their position implies vitalism, the view that a person's life should always be preserved; thus, they are open to the moral rightness "of removing medically provided nutrition and hydra- tion from the PVS patient without denying the personhood of these patients" (Ibid.).

[56] Moreland and Rae summarize Rachels' position on p. 319-324. They are following Rachels' discussion in *The End of Life* New York, Oxford University Press, 1986.

[57] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 324-25.

[58] Ibid., p. 325.

dead? But, Moreland and Rae point out, these individuals are not dead as persons, since they are living functioning organisms, with the ability to breathe on their own, needing only artificial nutrition and hydration (and ba- sic nursing care) to survive.[59] Anencephalic infants, who lack the upper part of the brain but have a brain stem, are also human persons. Individuals in a coma are also living human persons, even if they require a ventilator to sur- vive. Many of them die within a relatively short time ("a few weeks or months"), and thus they should be considered "terminally ill,"[60] not dead.

One might expect those pro-lifers of an Aristotelian-Thomistic bent to believe that "whole brain dead" individuals are also living human organisms and thus human persons. However, many follow the 1981 report of the Pres- ident's Commission for the Study of Ethical Problems in Biomedical and Be- havioral Research in accepting the position that organic integration in a hu- man being is lost when the entire brain, including the brain stem, perma- nently ceases to function.[61] Like the Commission, they argue that without the unique integrating functions of the brain, the body is no longer functioning as a unified organism.

The President's Commission claims that in the whole brain dead individ- ual, circulation and respiration are not signs of organic integration because the "lungs breathe, and the heart circulates blood only because the respira- tor (and the attendant medical interventions) cause them to do so, not be- cause of any comprehensive integrated functioning."[62] The Commission claims that asystole (cardiac standstill) is inevitable after whole 'brain death', as well as its rapid onset: "the heart usually stops beating [after whole 'brain death'] within two to ten days (but up to several weeks in a small infant)."[63]

[59] Ibid., p. 328.

[60] Ibid. It would be morally acceptable "to withdraw life-sustaining treatment from them on the grounds that it is futile," but this would not imply that actively killing such persons would be morally justified.

[61] President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: A Report on the Medical, Legal, and Ethical Issues in the De termination of Death*, Washington, DC, U.S. Government Printing Office, 1981, p. 33. Some of the material in this section appeared in a different form in M. Potts, *Pro-Life Support for the Whole Brain Death Criterion: A Problem of Consistency*, in *Beyond Brain Death: The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, p. 121-138.

[62] President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: A Report on the Medical, Legal, and Ethical Issues in the De termination of Death*, p. 37.

[63] Ibid., p. 17; D. Lamb, *Death, Brain Death, and Ethics*, Albany, N Y, State University of New York Press, 1985, p. 35.

Pro-life writers who support the whole ‘brain death’ criterion closely follow such reasoning. For example, in their endorsement of the whole brain crite- rion, Moreland and Rae state:

the whole-brain definition of death is consistent with a substance view of a person since once the entire brain ceases to function, heartbeat and respira- tion will cease as well. It is true that medical technology can keep a person’s heart beating and lungs moving after a declaration of ‘brain death’. In fact, this is often done when the family members designate organ donation. But once that technology is removed, cardiopulmonary function will stop, since noth- ing is functioning in the brain to give direction to the heart and lungs. Whole- brain definitions of death are most consistent with a substance view of the per- son, in which the person is a unity of biological, mental and spiritual compo- nents, grounded in an individuated essence - one’s human nature.[64]

Patrick Lee[65] and Norman Ford[66] make similar claims, to the effect that whole ‘brain death’ marks the end of a unified human organism. However, there are two main problems with such views: 1) the claim that the “brain dead” individual is not a unified living organism is empirically false and not in line with good science and 2) these views are logically inconsistent with other claims made by these same writers when discussing the beginning of human life.

Since the President’s Commission’s Report was first released, the evi- dence has mounted that whole brain dead individuals continue to function as unified organisms. Some integrative functions can be replaced by tech- nology. Even though a ventilator[67] can inflate the lungs and provide oxy- genated air, at the systemic level, respiration, the exchange of oxygen and car- bon dioxide, continues.

The circulatory system also continues to function in whole ‘brain death’, sometimes with the use of vasopressin and other drugs to regulate blood pres- sure, but in other cases these drugs are not needed. Some “brain dead” pa-

[64] Ibid., p. 337.

[65] P. Lee, *Abortion and Unborn Human Life*, p. 76.

[66] N.M. Ford, *When Did I Begin? Conception of the Human Individual in History, Philosophy, and Science*, p. 81.

[67] “Ventilator” is more accurate than “respirator” since, as Paul Byrne notes, respiration in the sense of the exchange of oxygen and carbon dioxide continues in the lungs, and is not a ma chine-driven process. The ventilator expands the rib cage and provides oxygenated air, rendering mechanical “ventilation,” not “respiration.” See P.A. Byrne, S. O’Reilly, P.M. Quay, et al., *The Pa tient, The Physician and Society*, p. 82.

tients maintain body temperature (an integrative function) but even if they cannot, body temperature can be artificially maintained. Brain functions which do help integrate the organism as a whole, such as hypothalamic-pitu- itary function, regulation of blood pressure and regulation of body tempera- ture, are not even excluded by whole brain criteria.[68] The rapid onset of asys- tole is no longer an inevitable result of "whole 'brain death'." Even before Alan Shewmon's seminal work, various studies had revealed that "brain dead" patients had survived up to 210 days (though they required, besides the ventilator, pharmacological support).[69] Commenting on some of these cases, Peter Black notes that "The rationale for accepting 'brain death' as an entity must be something other than the fact that the body inevitably dies soon after the brain is dead."[70]

In addition to these cases, there are a number of cases in which brain dead pregnant women have been kept alive (they were maintained for 24-107 days after the diagnosis of 'brain death') so that near full term infants could be de- livered.[71] Recent studies by Alan Shewmon have found cases of much longer survival, especially in brain dead children. The longest surviving brain dead

[68] D.A. Shewmon, *The Brain and Somatic Integration: Insights into the Standard Biological Ra tionale for Equating Brain Death with Death*, in "Journal of Medicine and Philosophy," 26, 2001,
p. 457-478 (p. 465). There has been a great deal of research questioning the idea that the whole brain is dead (in the case of 'whole brain' death accepted in the U.S.) or the brain stem is dead (in the case of the "brainstem" criterion for death, used in the U.K.). Besides the functions mentioned, EEG activity continues as well as heart rate and blood pressure responses to organ donation surgery. For discussions of continued brain activity in 'brain dead' patients, see K.G. Karakatsa- nis, J.N. Tsanakas, *A Critique on the Concept of 'Brain Death'*, in "Issues in Law & Medicine," 18, 2002, p. 127-141; D.W. Evans, *The Demise of 'Brain Death' in Britain*, in *Beyond Brain Death: The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges,
p. 139-158, and in the same volume, D.J. Hill, *Brain Stem Death: A United Kingdom Anaesthetist's View*, p. 159-169.

[69] T. Yoshioka, et al., *Prolonged Hemodynamic Maintenance by the Combined Administration of Vasopressin and Epinephrine in Brain Death: A Clinical Study*, in "Neurosurgery," 18, 5, 1986,
p. 565-567; Y. Kinoshita, et al., *Long-term Renal Preservation after Brain Death Maintained with Vasopressin and Epinephrine*, in "Transplant International," 3, 1990, p. 15-18; S. Taniguchi, et al., *Effects of Hormonal Supplements on the Maintenance of Cardiac Function in Potential Donor Pa tients after Cerebral Death*, in "European Journal of Cardiothoracic Surgery," 6, 1992, p. 96-102.

[70] P. Black, comment on Yoshioka, et al., "Hemodynamic Maintenance," p. 567.

[71] W. P. Dillon, et al., *Life Support and Maternal Brain Death during Pregnancy*, in "Journal of the American Medical Association," 248, 1982, p. 1089-1091; D.R. Field, et al., *Maternal Brain Death during Pregnancy: Medical and Legal Issues*, in "Journal of the American Medical Associa tion," 260 (1988), p. 816-822; I.M. Berstein, et al., *Maternal Brain Death and Prolonged Fetal Sur vival*, "Obstetrics & Gynecology," 74, 3, 1989, p. 434-437.

patient has lived for fourteen years in that state, and was alive (as of 1998) on a ventilator at home.[72]

Siegler and Wikler note that cases of long-term survival (they have in mind the cases of 'brain dead' pregnant women) show that if the 'brain dead' indi- vidual is a 'corpse', it has some unusual properties: It has been known for some time that brain-dead patients, suitably maintained, can breathe, circulate blood, digest food, filter wastes, maintain body temperature, generate new functions, and fulfill other functions as well. All of this is remarkable in a 'corpse'. Grant- ed, these functions could not be maintained without artificial aid and, even so, will cease within a few weeks. However, many living patients depend on ma- chines and will not live long; they are not thereby classified as (already) dead.[73]

Shewmon has also argued in detail that many 'brain dead' patients have at least the same degree of, and sometimes more organic integration than pa- tients with high cervical transection of the spinal cord who are clearly alive (and often conscious).[74] From the parallels, Shewmon concludes that there is no "central integrator" of the body (such as the brain), but that "integration is a holistic property deriving from the mutual interaction among all of the parts."[75] Elsewhere, Shewmon notes a number of somatically integrative, emergent, holistic properties which are not brain-mediated, among which are homeostasis from the chemical to the systemic level, management of bodily wastes, and energy balance. The brain "fine-tunes" an already integrated body rather than its function being a necessary condition for integration.[76]

[72] D.A. Shewmon *Chronic 'Brain Death': Meta-analysis and Conceptual Consequences*, in "Neu rology," 51, 1998, p. 1538-1545 (p. 1543); see also D.A. Shewmon, *'Brainstem Death,' 'Brain Death' and Death: A Critical Re-evaluation of the Purported Evidence*, in "Issues in Law and Medicine," 14, 2, 1998, p. 125-145. J.M. Eliot, *Brain Death*, "Trauma," 5, 2003, p. 23-42 (p. 32) notes that even if one questions some of Shewmon's conclusions concerning "brain dead" patients mentioned in his study, it is difficult to discount them all, and in any case, "If brain death is to continue to be accept ed as legal death, it must be on grounds other than the somatic disintegration hypothesis."

[73] M.Siegler, D. Wikler, *Brain Death and Live Birth (editorial)*, in "Journal of the American Medical Association," 248, 1989, p. 1101.

[74] See the table of parallels between high cervical cord transection and brain death in D.A. Shewmon, *The 'Critical Organ' for the Organism as a Whole*, in *Brain Death and Disorders of Con sciousness*, edited by C. Machado and D.A. Shewmon, p. 23-41 (p. 27). See also D.A. Shewmon, *Spinal Shock and 'Brain Death': Somatic Pathophysiological Equivalence and Implications for the In- tegrative-Unity Rationale*, in "Spinal Cord," 37, 1999, p. 313-324.

[75] D.A. Shewmon, *Spinal Shock and 'Brain Death': Somatic Pathophysiological Equivalence and Implications for the Integrative-Unity Rationale*, p. 322.

[76] D.A. Shewmon, *The Brain and Somatic Integration: Insights into the Standard Biological Ra tionale for Equating Brain Death with Death*, p. 459-460.

It is clear now that the evidence is overwhelming that the "brain dead" individual is an integrated, living organism-a human being-and thus, on the Aristotelian-Thomistic account of human nature, is a human person as well. Thus, to be consistent with such a metaphysics, those who believe that the zygote, embryo, or fetus (as well as PVS patients and anencephalic infants) are human persons must also believe that "brain dead" individuals are hu- man persons.

In response, the Aristotelian-Thomist may claim (as do Moreland and Rae) that since the whole brain dead individual depends on machines for organic unified functioning to continue, this means that he or she is not functioning as a unified whole. However, neither dependence in itself nor dependence on machines is sufficient for denying personhood to an individual. The fetus, for example, is dependent on the mother's body for survival. If dependence is ir- relevant to judgments of when life begins, why should it be any more relevant to the issue of when life ends? As Steven Schwarz states, arguing for the per- sonhood of the fetus, "[d]egree of dependency is relative. It is, precisely, a matter of degree, of more or less. Everyone is dependent on others to some extent, physically and psychologically."[77] Someone who argues that depen- dency is irrelevant for the determination of when life begins cannot consis- tently argue that it is relevant for determining when life ends. It will not help to say that dependence on machines is different than dependence on the mother's body. It is true that the brain dead patient depends on machines to keep his or her body alive. But others are dependent as well; someone with a severe spinal cord injury may be permanently dependent on a ventilator to live, but he or she is obviously not dead. Some individuals need artificial pace- makers in order to live, but such dependence does not make them dead.

My opponent could argue that I am "mixing apples and oranges," that the beginning of life is not parallel to the end of life, in the following way (paraphrasing Stephen Schwarz)[78]: "A zygote, embryo, or fetus will develop into an independently functioning human being. A brain dead individual will not; his or her dependence on machine support shows that he or she is not a unified human organism. In the case of the fetus, his or her dependence is merely a function of his or her stage of development; in the case of the indi- vidual with whole 'brain death', his or her dependence is due to the perma- nent loss of the functions of his entire brain. The fetus, given his or her level

[77] S. Schwarz, *The Moral Question of Abortion*, p. 16.
[78] Ibid., p. 50-53.

of development, has his or her integrating system intact; the brain dead indi- vidual does not. The only reason a pre-viable fetus cannot survive outside its mother's womb is that this is appropriate given its degree of development. The dependency in the brain dead patient is not appropriate to that individ- ual in the same way. Therefore, the parallel you allege fails."

The proper answer to this argument is "So what?" There are cases in which adults who are conscious are totally dependent on machines, and this is not appropriate to their "level of development" either. They are not dead. Retreating to an appeal to the capacity for consciousness defining human per- sonhood is not open to someone who accepts the Aristotelian-Thomistic view of personhood. The only viable option for consistency is to say that death oc- curs when the integrated organic unity of the body breaks down due to de- struction of systems necessary for bodily integration. Following Paul Byrne and his colleagues, I take "to destroy" as meaning "to break down or disin- tegrate the basic structure of," "to disrupt or obliterate the ordered unity of."[79] They further note that "'destruction' indicates the loss of structural po- tentiality for functioning, the cessation of the organic capacity to function."[80] It is necessary to speak of destruction at the level of systems and not at low- er levels because, for instance, a vital organ which has been destroyed, such as the heart, could be replaced by a mechanical device.[81] There are three sys- tems that, if destroyed, clearly mark the destruction of the human body as an organic whole: the cardiovascular, the respiratory, and the nervous. The de- struction of each is individually necessary and jointly sufficient for the decla- ration of human death. Byrne et al. correctly point out that determining when such destruction occurs is a medical and scientific issue.[82] Due to the moral implications for the practice of removing vital organs for transplantation from 'brain dead' beating-heart donors, this may be a hard pill for the Aris- totelian-Thomist to swallow. But giving up a consistent position is something impossible to swallow.

[79] P.A. Byrne, S. O'Reilly, P.M. Quay, et al., *The Patient, The Physician and Society*, p. 77, end- note 34.
[80] Ibid., p. 59.
[81] Ibid., p. 60.
[82] Ibid., p. 60-61.

III.

In this final section I will discuss and critique an important approach to the issue of the declaration of death which threatens the position developed above: John P. Lizza's non-Lockean justification of higher 'brain death'. Sev- eral advocates of higher 'brain death', such as Robert Veatch, Karen Grand- strand Gervais, and Lizza have presented alternative justifications for the permanent loss of capacity for consciousness marking the death of the per- son, one they believe avoids the problems in a functional Lockean ap- proach.[83] Although their positions differ in significant ways, their family re- semblances are close enough to group them together; I will focus on Lizza's position. Lizza accepts the view that recent evidence shows that brain dead individuals are living human organisms. But Lizza also believes that the ac- tual basis for people accepting 'brain death' as the death of the person is the view that "it constituted the irreversible loss of consciousness and every other mental capacity and function."[84] Those who advocate such a view of death, Lizza says, hold that "what remains alive [after the parts of the brain re- sponsible for conscious experience have been lost, M.P.]… must be either a human being, as distinct from a person, or a being of another sort, e.g., a 'hu- manoid' or 'biological artifact'."[85] Lizza is sympathetic with those, such as H. Tristram Engelhardt, who distinguish "human biological life from human personal life."[86] Presumably, Lizza would also sympathize with James Rachels, who distinguishes between biological and biographical life, with the latter requiring, at the very least, consciousness.[87] However, Lizza does not accept the Lockean functional definition of human personhood, and pro- poses an alternative position according to which a human person "is a prim- itive substance that necessarily has psychological and corporeal predicates."[88] Lizza believes that this position "entails that the person must have the ca-

[83] J.P. Lizza, *The Conceptual Basis for Brain Death: Loss of Organic Integration or Loss of Con- sciousness*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shew- mon, p. 51-59.
[84] Ibid., p. 52.
[85] Ibid.
[86] He is referring to H.T. Engelhardt, Jr., *Medicine and the Concept of Person*, in *Ethical Issues in Death and Dying*, edited by T.L. Beauchamp and S. Perlin, Englewood Cliffs, NJ, Prentice-Hall, 1978, p. 271-184.
[87] J. Rachels, *The End of Life*, New York, Oxford University Press, 1986.
[88] J.P. Lizza, *The Conceptual Basis for Brain Death: Loss of Organic Integration or Loss of Con sciousness*, p. 56.

pacity or realistic potential for psychological functions. This cannot be said about a corpse or about some living members of the biological species Ho- mo sapiens, e.g., anencephalic infants and individuals in a permanent vege- tative state."[89] Such 'higher brain dead' individuals are dead qua persons.[90] Lizza is to be commended for accepting a substantive, rather than a func- tional, view of the human person. His view that a person has both psycho- logical and corporeal predicates is also a plausible position which reflects the dual nature of human beings (with both physical and mental attributes) also affirmed by the Aristotelian-Thomistic view of personhood.[91] The problem with Lizza's position is that he defines 'capacity' too narrowly, in terms of the immediate ability to exercise a particular capacity. But this ignores the dis- tinction between ultimate capacities, which belong to a person simply by be- ing a member of the human species, and lower level capacities which are nec- essary for the ultimate capacities to be expressed. Thus if Jane Doe is un- conscious, even permanently so due to irreversible brain damage, as long as her body is alive she still retains the higher level, ultimate capacities for con- sciousness, reason, beliefs, emotions, etc. Thus, it would be correct to say that "Jane is a rational animal," even if she cannot actively express such rational- ity. Lizza's view is a form of actualism, which holds that one must actually be able to exercise capacities at a given moment to have the capacities. But as Moreland and Rae note, "The capacity to have a biographical life... presup- poses" having a biological life. "Thus, a person's biographical life is ground- ed in his or her biological life by being a particular kind, a human being."[92] But Lizza's claims can also be turned on their head. Suppose a patient has "locked-in syndrome," in which he or she loses almost all physical capacities (except the capacity to open and blink one's eyes), but retains mental capac- ities-surely this individual is no less unified, no less a person, than someone with normal physical abilities. Suppose this patient loses the ability to blink his or her eyes, but still retains consciousness. Almost all physical predicates could no longer be applied to this individual except for those referring to ba- sic bodily functions such as circulation, respiration, digestion, and excretion. Yet this individual remains a human person. Why should it be any different in the case of a patient who loses the immediate capacity for conscious expe-

[89] Ibid.

[90] Ibid., p. 58.

[91] David Braine has developed a similar philosophical anthropology in *The Human Person: Animal and Spirit*, Notre Dame, IN, University of Notre Dame Press, 1992.

[92] J.P. Moreland, S.B. Rae, *Body & Soul: Human Nature & the Crisis in Ethics*, p. 324-325.

rience (though not the species-specific ultimate capacity) due to 'brain death'? Lizza's metaphysical position on personhood may be correct, but his application of that metaphysics falls into a new dualism. This was noted over thirty years ago by a philosopher working within the phenomenological tra- dition, Hans Jonas, in his attack on 'brain death' criteria:... the true human person rests in (or is represented by) the brain, of which the rest of the body is a mere subservient tool. Thus, when the brain dies, it is as when the soul departed: what is left are "mortal remains." [But the body has] its essential share in the identity of the person. The body is as uniquely the body of this brain and no other, as the brain is uniquely the brain of this body and no oth- er. What is under the brain's central control, the bodily total, is as individual, as much "myself," as singular to my identity (fingerprints!), as noninter- changeable, as the controlling (and reciprocally controlled) brain itself. My identity is the identity of the whole organism... Therefore, the body of the co- matose, so long as-even with the help of art-it still breathes, pulses, and func- tions otherwise, must still be considered a residual continuance of that sub- ject that loved and was loved, and as such is still entitled to some of the sacro- sanctity accorded to such a subject by the laws of God and men. That sacro- sanctity decrees that it must not be used as a mere means.[93]

This view affirms the unity of the human person and the value of biolog- ical life. As John Kleinig notes, "Karen Ann Quinlan's biography did not end in 1975, when she became permanently comatose [more precisely, when she entered a permanent vegetative state, M.P.]. It continued for another ten years. That was part of the tragedy of her life."[94] The histories of "brain dead" persons continue, although little of their previous powers remain.[95]

The task I have attempted in this paper has been to set forth a viable philosophical anthropology, a metaphysics of the human person, and to ap- ply that consistently to the beginning and end of life. Given the view set forth, that all human beings, all living human organisms, are human persons, then such personhood belongs to the zygote, embryo (including frozen ones), fe- tus, PVS patient, comatose patient - and to the 'brain dead' patient.

[93] H. Jonas, *Against the Stream: Comments on the Definition and Redefinition of Death*, in H. Jonas, *Philosophical Essays: From Ancient Creed to Technological Man*, Englewood Cliffs, NJ, Pren tice-Hall, 1974, p. 139.

[94] J. Kleinig, *Valuing Life*, Princeton, Princeton University Press, 1991, p. 201.

[95] Ibid., p. 218.

*On 'Brain Death' in Brief: Philosophical Arguments against Equating it with actual Death and Responses to "Arguments" in favour of Such an Equation**

JOSEF SEIFERT

In the following, I wish only to state in succinct form the most important theoretical arguments advanced in favor of equating 'brain death' with actu- al human death and state my main objections against such an equation. Due to the purpose of this brief text, I will omit many references and not treat sub- ordinated arguments pro and con 'brain death' definitions of death that are treated in my long paper for this conference.

I. *The Bio-philosophical Argument from a Loss of Integrated Wholeness*

Statement of the First Basic Argument in Favor of Brain Death: The brain is the condition and cause of integrated physiological life in the whole or- ganism and of life of the human organism as such. Such an integrated life of the human organism as a whole in its well-ordered connections, which over- come a state of mere isolated organic life in the different cells and organs, is human life. The irreversible dysfunction of the brain ('total brain infarction,' or also, in other theories, the dysfunction of merely the brainstem alone) is actual death because the irreversible 'brainstem' or 'whole brain-infarction' destroys the integrated unity of the single life-events in the body cells and or- gans and reduces the body simply to a big organ-bank that is not essentially different from extracted isolated organs in a refrigerator which 'live' after the obvious death of a person. Therefore the irreversible dysfunction of the

* Presented for possible discussion at the Conference on the "Signs of Death," The Pontifical Academy of Sciences, Vatican City, February 3-4, 2005.

brainstem (or of the whole brain) is rightly called ‘brain death’, meaning the death of the human organism in its integrated wholeness. Moreover, this death of the human organism as a whole also implies the death of the human person. Hence the ‘brain death’ of a human being is human death simply speaking or, if we take death in its metaphysical sense of a spiritual soul hav- ing left the body, it is a clear and unambiguous sign that death has taken place.

II. *Objections against This Argument:*

1. *Empirical Argument (with Philosophical Presuppositions and Implica tions) from the Presence of Consciousness in Some Cases after the Loss of Integrative Unity*

Human life is always present when a human being possesses conscious- ness. Human consciousness necessarily implies and presupposes the life of the conscious subject.
Human consciousness is clearly present in cases in which all integrative function of the brainstem for the rest of the body is absent due to certain le- sions that separate the body not only from the functions of the brain stem but also cut the Vega nerve and other forms of linking the brain and the rest of the body.
It follows that the presence of human life linked to the human body does not necessarily depend on the integrative role of the brainstem for bodily functions.

2. *An Empirical and Philosophical Argument against ‘Brain Death’ Being actual Human Death from the Many Levels of Integration and from the Artificiality of Taking Some of These into Account while Ignoring Oth ers in the Determination of Life*

While the deepest level and source of ‘integration’ of all dimensions of bodily life is achieved through the presence of a single spiritual soul of man, ‘integration’ has also a multitude of more empirical spiritual, psychological, and biological levels. Many of these are not even realized in normal persons, but only in the perfect person. Speaking only of biological integration and in-

tegral biological functions which encompass the whole body in an ordered fashion, many of these are present also in the 'brain dead' person. If we com- pile two lists of integrated aspects and functions of the human organism, one of them for which brain stem functions are responsible, another one for which other causes are responsible that exist also after the dysfunction of the brain stem, these lists are more or less equally impressive. Which justification do we have scientifically or philosophically speaking for just identifying the one list of integrated functions (which depend on the functioning brain stem) with human life, while ignoring the other one (also present in the brain dead person) as if it were insignificant? This is arbitrary and untenable both from a medical and from a philosophical point of view.

3. *Philosophical Arguments against Brain Death Definitions because of the Alleged 'Loss of Integrated functions': The Irreducibility of Human Life to 'Integrated Functions' Provided by the Brain(stem)*

Human life is deeper than all integrated functions of the brain and all in- tegration and unification of the vital events in the single cells and organs of the body. Human life is ontologically rooted in both the *life of the soul*, which con- stitutes the core of the essence of human life (and exists also after death, giv- en that the human person has immortal life), and in *the presence of the soul in the body and in the living organism*, which constitutes earthly human life. This human life rooted in the human soul present in the body, however, can in no way be reduced to the integrated wholeness and order of the multiple and di- visible biological life-events in the organically living units of the single bodily cells and organs. *Earthly* human life has its seat and origin in the individual, simple, indivisible, and rational human soul's *real presence* in the body. Therefore human life on earth ends when the human soul ceases to be present in the body and not before.

The presence of the human soul *in the body*, and therefore of human life, cannot be refuted by pointing out the lack of integrated wholeness of brain- and other bodily functions, as long as organic human life of the body as a whole, even without the integrative function of the brainstem, is present. For the presence of the human soul, and therefore of human life, which has its root in the presence of the living spiritual soul in the body and *not in mere integrated organic wholeness*, cannot be refuted by pointing at the absence of *part* of the integration of biological organic life.

In order to understand this argument well, we must distinguish clearly in which sense 'integrated human life' is a condition for the presence of human life (human soul) in the body, and in which senses it is only a condition of health or complete actualization of human life.

1) Biological Life in Isolated Cells and Organs versus Human Life of the Human Being (Organism as a Whole or 'as such') - Life in single isolated hu man cells and organs is not human life: each live body cell contains the human genome and also is in some sense 'alive' in a specifically human sense. In this sense, human life exists in each single human cell but also in isolated cell-cul tures, organs, or organ banks. The living cell can be severed from the human body and its life certainly is not the life of the human being because it can:

a) clearly outlast death,

b) be severed from the body and 'kept alive' even during the life time of the cell-donor,

c) lose life without any human person having died.

As Partial physiological life of isolated single cells and organs obviously *is* human life in the proper sense. If the life of the human body after 'brain death' were just that type of life, the earthly human life would indeed have ended in 'brain death'.

2) The integrated physiological life in the human body with all basic uni fying and integrating functions of the spinal cord, of the endocrine system as well as of the nervous system including the brain: this life certainly does not coincide with the life in the single cells and organs which can be preserved in a refrigerator after the death of an individual. Nor does it coincide with the total biological life in all the cells and organs of the human body, a life not found in any one of us because in all of us some cells or even whole limbs or organs are dead or missing. Human life as integrated life of the organism as a whole moves radically beyond the previous concept of human life and adopts an entirely new category to understand life: integrative unity. It is based on the insight that the organism is more than the sum of its parts, and that it is another kind of totality than a mere summary or than a fusion: the organism as a whole is divided into organic parts and organs, it is a whole which transcends the sum of its parts and contains them rather than just be ing their sum-total. The single cells and organs within the organism have the nature of parts; and these possess their meaning only within the whole; and the whole contains its parts in an orderly fashion but exceeds them. One could believe that this integrated life of cells and organs is precisely what hu man life is. For life in the single cells:

(a) in the first place (obviously) is not human personal life (given the evidences offered under 1 above), nor can human life properly speaking be identified with the life of the whole human organism including all cells and organs.

(b) Thus it appears that we have only the choice of recognizing the integrated physiological life in cells and organs as being human life. Integrated human life exists even when single organs and cells are missing.

Now let us state clearly three things:

firstly, it is more the *healthy* organism which possesses this integrated wholeness fully than just the live organism as such; what about the life of the paralyzed patient or the conscious person whose brainstem in virtue of some leisure exerts no more integrating function? The breakdown of integration here is a sign of unhealth but not of death.

Secondly: if this well integrated biological human life, at least inasmuch as its integration depends on the brainstem, were really identical with what human life properly speaking is, then the argument for 'brain death' being identical with actual human death would be both valid and sound.

This leads us to a third point: in reality, however, human life is much more than, and quite different from, integrated biological life in all basic body parts and many different cells and organs. And this is not only true because such an integrated whole of living parts is more the nature of *health* than that of life but for another and very different reason as well. The conception of hu- man life as an integrated whole of vital processes in organs and cells moves entirely on the level of purely vegetative life such as that of a plant and is even reductionistic and insufficient regarding purely vegetative life. But already animal life and especially human life requires an entirely new conceptual framework to be understood. This can be seen both when we consider a more proper medical notion of human life and a more profound *anthropological and metaphysical* sense of human life.

Fourthly, the life of the human organism as a whole, or the organic life of the human body as such, the absence of which is biological death: this notion of human life is not the same as that of the integrated human life though it has some connection with it and requires also some degree and kind of integra- tion. While this vegetative life of the organism as a whole obviously requires some considerable extent of the astonishing order and integration without which no organic living being exists, human life certainly can exist without complete integration or even without the presence of all basic bodily organs or functions. It is precisely this life of the human organism qua organism,

which is the proper medical sense of human life and which transcends the mere level of vegetative integrated wholeness of the organism. But how and where is the line which separates this organic life of the organism qua organ- ism, or the organic life of the human body as such, from the partial life process- es in single cells and organs as well as from the integrated whole of biological life processes? Here lies the crucial question. And how does human life of the human organism as such differ from a merely vegetative life of an organism as a whole with its divisible structures that characterize plant life? In the sensi- tive life of animals we encounter already a new world, that of some animal con- sciousness, the abilities to perceive, to learn, to feel, to have many experiences. Correspondingly, we find already in the animal a center of experience. Of course, rational human life is far more fundamentally different from the pure- ly vegetative life of a plant. In attempting an answer to this question, we reach another astonishing discovery: this organic life of the human body as such can- not be conceived simply in terms of the integrated whole of vegetative process- es and organ functions, but has quite another reference point in the feeling or perceiving of a single subject-center, or rather in that subject itself which is en- dowed with the potentiality of feeling and experiencing. Also for this reason of the essential difference between the composite whole of a pure organism endowed with vegetative life and a human living subject, human life (and even animal life) can clearly exist even though single parts and organs of the body are missing, as well as parts of the integrated order and function of the phys- iological processes in an organism may be absent, for example in the paralyzed or otherwise severely injured or physically handicapped person.

Now let us return to our question: what then divides the life of a human *being* from that of isolated life-processes? The interesting fact is that in a hu- man being the dividing line or demarcation between the vegetative life of the human organism as a whole and the mere life of isolated parts thereof (of or- gans) is *not* determined solely by criteria of organic life and integration close to the general system theory. It is not even graspable in terms of more ade- quate categories appropriate to organic life. Instead, the essential organic life of the body can only be understood and delineated properly from life in the sense of partial organic processes if it is understood precisely in its relation- ship to a *higher level of life and soul* than vegetative life, to a unified center of life already given in animals. The life of the human organism as such can only be understood in reference to the source of human life in a rational human soul which (according to Thomist philosophy and Catholic Church Teaching for which we can provide also philosophical arguments) is *one single soul* that

exercises also a sensitive and biological role. And herewith we come to a more appropriate philosophical comprehension of human life. This life is not the integrated (vegetative) life of the human organism as a whole; it is *not mere organic biological life at all*, but it is:

(3) The life of the spiritual human soul in the body: *I* do not here declare an absolute identity of the biological life in the human body as such and the rational human mind. Such an identity is ruled out by the fact that living cells can be preserved and continue to live after the person's death whose cells or cell-cultures are still being maintained alive. Nevertheless, there is an essen- tial connection between the human soul's life and biological life in the prop- erly human sense. The 'holistic' life of the human organism as such, or the es- sential dimension of biological human life which allows us to speak of a liv- ing human being rather than an organ-bank is characterized primarily as that part of biological life which is the condition of life in the properly human sense, namely the life of the human person which transcends the entire sphere of integrated (or non-integrated) biological processes and functions. We can- not understand this human life in terms of the categories appropriate to trees. The properly human life, however, is a life not directly open to medical meth- ods of knowledge and research. It must be sought by entirely different meth- ods and lies on an entirely different order of being.

Given the evident and absolute indivisibility and the rationality of the hu- man soul, this life of the human person as the life of the intellective human soul in the body obviously must *not* be identified with integrated bodily func- tions or with the manifold integrated physiological life processes in different cells and organs.

Moreover, this properly human life on earth, namely the life of the incar- nate human soul and of a "person in the body," is not only different from the integrated organic life of all basic organs of the body, but also has no evident condition in it (identity and condition being two entirely different things). The life of man certainly exists in the disintegrated body of a person who is still conscious but whose brainstem is dysfunctional and whose other con- necting pathways between brain and body are dysfunctional, possibly in virtue of a lesion of the spinal cord. All that human life requires necessarily is the minimal part of integration necessary for the life of the organism as such, or perhaps more precisely: the part of biological life necessary for the presence of the soul in the body. Thus we understand why the life of the hu- man person and why human life as well as life of the human organism as such cannot be identified with integrated wholeness of biological processes.

And thereby we reach a main root of the error of the 'brain death' con- cept which conceives human life in biologistic terms as the life of an integrat- ed whole of organs and cells. This biological notion of life and 'brain death' goes back to a fundamentally flawed biologistic concept of human life which leads both to a false concept of "integrated life of the human organism as a whole" (conceiving it physiologistically as if it were mere vegetative life) and to a failure to see that also the biological life of the organism as such is not hu- man life but only indicates the presence of human life and renders it possible in its incarnate form. Human life, also in its concrete incarnate form, derives solely from the presence of the intellective human soul in the body.

Now we can take another important step: what is important in the con- cept of the integrated life of the organism as a whole, as the life of the body as such (or as a whole), is not that it be the integrated life of the organism as a whole. What counts is not that we deal with an organic life that character- izes the living body in its integral wholeness rather than just being the life of a few isolated organs and cells, but that it be that life of the human body which derives from and is necessary for the mystery of the incarnate presence of the human person, for the union of body and soul.

Someone might object and say that the only criterion we have in medicine for knowing that a person is alive is to know the integrated wholeness of his biological life. But also this assumption is plainly false. For it is clear that the human life in the sense of the presence of the human soul in the body cannot simply be refuted by proving the absence of integrated bodily function, es- pecially by the absence of that integration which is accounted for by the brainstem. For this integration is also absent in some cases in which con- sciousness, and with consciousness necessarily personal human life, is still present. But if this is undoubtedly the case, it is by no means clear that the life of the personal soul in the body could not very well be present even after the irreversible dysfunction of the brain. Think here also of the reference above to the empirical argument against 'brain death' (with philosophical presuppositions and implications) from the presence of consciousness in some cases after the loss of the integrative bodily unity effected by the brain stem. In these cases the presence of consciousness testifies with indubitable certainty that human life in the present full sense can be present even after the loss of integrative bodily life in virtue of a dysfunctional brain stem.

Therefore, this life of the human body, and the presence of the soul which has its condition in it, may very well be present in the brain dead individual. And this leads us to a further meaning and level of human life:

4) The life of the human soul itself which can and will persist even after death: Of course, philosophically speaking, human life does not end there ei- ther. For while in the specifically *human life* on earth the two just discussed meanings of human life are the most decisive ones, the ultimate seat and ground of the life of the human *person* is deeper still. It is not the life of the soul *in the body,* but the life of the soul itself, which is also the deepest ground and source of personal life on earth: the human life on earth is precisely the life of the soul as long as it is *united with the body* and *vivifies the body of the human person,* bestowing its own life on the body and making the body par- ticipate in it. And this life can precisely also exist outside of, and apart from, the body, as the philosophical arguments for the immortality of the human soul show.

In the light of these reflections on the nature and different data we call human life we see more clearly why any reduction of human life to integrat- ed function is wrong and why the loss of part of bodily integration and co- ordination through brain stem death is no good reason to claim the death of the individual person.

II. *Presentation and Critique of the Second Group of Main Reasonings in Favor of 'brain death' being actual Death: the Idea of the Brain alone being the Real body, i.e., the seat of the Human soul - Brain Tissue and Brain Functions Conceived as the Only 'Incarnational Element', the real 'Body in the Body'*

Statement of the second group of arguments in favor of identifying 'brain death' with human death - Empirical Argument from the Brain as 'Incarna- tional Tissue' and as the Only Part of the Body in Which the Soul would be pre- sent: "Brain functioning is the absolute condition for the presence of the hu- man soul in the body. Therefore, as the functioning brain is the only neces- sary and "incarnational tissue" that allows the human soul to dwell in the body, the death of the brain equals the death of the soul which then leaves the body when the brain is irreversibly dysfunctional. In support of this view one may reason: it is clear that many parts of the body can be removed with all biological functioning in them (like legs can be amputated), without the person dying. It is also clear that there is a limit of such dissecting and dismembering live human bodies, and that some part of the body must be such that it "ties the soul to the body"and is that incarna- tional tissue or that set of incarnational functions without which the presence

of the human soul in the body is impossible. Eccles and others have claimed that instead of a body/mind problem there is only a brain/mind problem. They regard the human brain as the only seat of the human soul. If they are right, the irreversible dysfunction of the brain coincides indeed with death." But against this argument we can raise a great number of objections.

1. *Objections against the Thesis that the Brain is the Only Seat of the Human Soul*

a) *Objection from early embryonic life*: The thesis that human life requires a human brain or even a functioning brain is already refuted by the fact that the brain appears much later than human life and that therefore human life is present independently from, and prior to, brain function. The objection that in the early stages of embryonic life there is the *potential to develop a brain* (that is lacking in the brain dead person) does not help because a "mere potential to develop a nervous system *is no nervous system or brain*," therefore if a functioning brain were a condition of the soul's presence in the body, the early embryo could not have a soul nor be alive in the sense of human life. This objection addresses itself only to those who acknowledge this consequence as false or even absurd.

b) *Argument from the (partly successful) research done on implantations of brain-cells*: Against the claim that the functioning brain is the only part of the body that "really matters" as seat of the soul, we may also object on the basis of the possibility of brain implantations and injection of brain cells (which are at least possible in principle, and actually possible today within the certain limits). If brain cells can be injected and used by the human person who is their recipient, then the easy assumption that simply the brain is the place of incarnate presence of the human person becomes very questionable. For in the injection of brain-cells it is obviously not the brain cells which determine the mind or soul being present in a body but these brain cells are used by the person whose brain cells were destroyed and who now receives a 'new brain.' If one were able to implant an entire brain, it is thus very possible that the person of the brain recipient would not be the person whose brain one took but the recipient of the newly implanted natural or artificial brain. But then the entire thesis that the human mind is just located in the brain and that therefore irreversible brain infarction is death loses any rational justification on those grounds.

c) *Objection from brain-plasticity: In hemispherectomy we can remove the non-dominant cerebral hemisphere without great damage to life and conscious life of the person*: we also can remove the dominant hemisphere in adults and children after which severe handicaps ensue but human life clearly continues; in small children the possibilities of rehabilitation after hemispherectomy of the dominant hemisphere and the adaptation of the non-dominant one which now assumes many functions previously exerted by the (removed) dominant one confirm the same point.

One could argue against this that brain plasticity (as manifested by hemispherectomy and congenital decortication examples) is not relevant to the ontological issue of 'brain death', since plasticity of the brain just implies that one part of the brain can assume functions previously mediated primarily by some other parts of the brain which are now damaged or removed. In 'brain death', however, the entire brain is infarcted, so that no part and function of the brain can assume the functions of the destroyed brain tissue.

Now one has to distinguish three different problems towards the solution of which a philosophical reflection on the implications of brain plasticity may serve:

1. The first of these problems is the distinctness between mind and brain for which brain plasticity provides a significant argument. While the distinction between mind and brain follows from many other premises and requires firmer foundations than just brain plasticity, it is nevertheless evident that certain forms of mind/brain identity theory can be refuted by meditating on brain plasticity. The unique and individual human soul (mind) cannot be identical with parts of the brain or with the functions therein, if it can continue to exist and to operate even after these parts of the brain have been removed and a fortiori all its functions have ceased to exist. If hemispherectomy leaves a conscious person intact, one must assume some independence of the mind from the cerebral hemispheres and cannot claim an identity of the mind with specific brain functions and parts of the brain. Moreover, how can the unique individuality of the same person continue to exist after the most decisive parts of the brain and all its functions have been removed, if the person were reducible to brain functions or their epiphenomenon?

2. Secondly, the issue of brain plasticity is significant when the brain is equated with the incarnational tissue or that incarnational functional whole that unites body and mind, or with that part of the body which alone is the seat of the soul and whose destruction would therefore be the end of life. This

role of either one of the hemispheres, at least the assumption of a sort of lo- calizable incarnational brain tissue or brain function in the cerebral hemi- spheres, is certainly refuted if the mind continues to work after destruction of even the dominant cerebral hemisphere.

One has to concede to the above objection that purely formally logically speaking it does not follow from brain plasticity that the human soul is dis- tinct from the brain or could survive the destruction of all brain functions. Brain plasticity only demonstrates formally speaking that neither the function of the dominant cerebral hemisphere nor the function of the non-dominant one is necessary for the existence and the incarnate presence of the mind, and one cannot conclude from brain plasticity on purely formal-logical grounds that not some brain activity is necessary for the existence of the mind or its presence in the body. It is true that from the premises 'B does not imply nec- essarily B1' and 'B does not necessarily imply B2' it does not follow that it does not imply either "B1 or B2."

But this formal-logical truth does not do justice to our problem. If one considers the problem at hand here, the presence (incarnation) of the mind (which can be proven to be ontologically different from the brain and is tak- en here to be thus different) in the body, then it seems indeed that brain plas- ticity throws a deep suspicion on the thesis that the mind is exclusively pre- sent in the brain. For while the mysterious presence of the soul in the body is not physical, it nevertheless implies a uniquely close link between a soul and a concrete body also with respect to its physical and organic reality. If therefore it is proven that neither one of the cerebral hemispheres, even not the most likely candidate, namely the dominant hemisphere, is the seat of the soul in the body, then it emerges at least as probable that the incarnational role of the body is not exercised by the brain alone, a point further confirmed by the late appearance of the brain.

3. Thirdly, this argument from brain plasticity could refer to an entirely different problem, namely to the role of the brain as *condition* of *actual* mental activity (as opposed to the presence of the mind and its fundamental *faculties)*. Now with respect to this role of the brain for the mind one can concede fully that the plasticity of the brain does not at all prove that no higher brain function is an empirically necessary condition for mental activities.

d) *The objection from children with virtual absence of the entire cortex*: The most stunning empirical support of the thesis that the mind cannot be exclusively incarnated in the cerebral hemispheres is provided by the case studies on hydranencephalic children undertaken by D. Alan Shewmon, in

which it was shown that even the brainstem can take on some of the func- tions of the cerebral hemispheres. If the results of this investigation hold up upon close scrutiny, the experiences on which they are based, disprove de- finitively the claim, held by Sir John Eccles, that the cerebral hemispheres alone constitute the part of the body which is indispensable for the incar- national presence of the human soul, and thereby of human life, in the body.

III. *The Third Main Argument in favor of Brain Death from the Role of the Brain for Conscious Life and the Impossibility of a Brain Dead Patient ever again Having Conscious Life or acting as a Person.*

Presentation of the Argument: a brain dead individual will never again reach conscious life or act as a person. Because the very basis in the brain for performing conscious acts and the potential for consciousness is destroyed, he can be called 'dead' as person because the low and irrational quality of his life does not merit the name of 'life'.

Critique of the Third Argument: although the importance of rational con- sciousness for human life is immense, the being a person and the acting as a person are distinct! Not only the existence of the person and her life, but al- so her fundamental potencies and faculties, preceding any and all activations, are irreducible to their actualization and irreducible to brain states.

The third argument in favor of 'brain death' involves an actualism which denies that the substantial reality (and life) of the soul as well as the funda- mental faculties of the mind can exist even if they cannot presently or ever again be exercised. Again, the argument entails the right insights that poten- cies of the form of actual abilities towards certain doings of the person are here destroyed, and that even the fundamental potentialities linked to men- tal faculties (to think or will) are not any more capable of being exercised in this life, as far as we know. But from this it does not follow in any way that these fundamental faculties themselves would have ceased to exist and may not be actualized once again (either if brain transplants or injection of brain tissue can resolve these problems, or after death). Therefore, the living al- though irreversibly handicapped person is still a person even when she can- not act as a person.

IV. *Conclusions for the Signs of Death Issue*

1. *Signs and Criteria of the Presence of human Life (Life of the Human Organism) and The Absence of All of Them as Sign (Criterion) of Death*

We can safely assume that there is universal consensus regarding the dif- ference between *human* life (life of the human organism or life of the incar- nated human being) and partial life-processes in cells, cell-cultures, refriger- ated or transplanted isolated organs.

Therefore, a decisive question to clarify in the context of the 'brain death' discussion is to determine as clearly as possible the unambiguous positive signs of the presence of human life (life of the human being as such and pres- ence of the human soul in the body, as opposed to life in isolated organs). Equally decisive is the question of an unambiguous criterion for the absence of human life (or of human death). Here we are not concerned with the philo- sophical question of the ultimate metaphysical essence of human life and death nor with the purely empirical side of our question, but with a philo- sophical analysis of those signs and criteria which manifest properly human life or its absence. I think that the criteria for the presence or absence of hu- man life usually proposed in the 'brain death' debate are false or insufficient. Therefore, I wish to propose in the following six positive criteria, each of which I will argue to be self-sufficient as sign of the presence of human life. Each of these criteria allows us to say, albeit with a different degree of cer- tainty, that human life is present or (in the case of the weakest criteria) must at least be assumed to be present. On the other hand, and as a logical conse- quence of the auto-sufficiency of each of these positive criteria, the death of a human being must only be affirmed when all six signs or manifestations and criteria of human life are absent.

a. The first and clearest of these signs which evidence the presence of human life is the existence of human consciousness linked to a body: For human consciousness presupposes human life. If human consciousness is present, we are faced with an indubitable evidence of human life which does not need any reference to integrated bodily function. There are some conscious human beings who are, with respect to the absence of an integrative function exercised by the brain stem, in the same or even a worse condition than brain dead individuals. This allows us to see that the integration of functions for which the brain(stem) is responsible, is not necessary for human life.

b. Functions of the human body as a whole such as growth of the body as a whole: we have no right to claim that an organism as a whole is dead as long as we find such biological activities of the body *as a whole* and "total func tions" as exercised by each of the parts of an organism (cells, organs) as well as by the organism as a whole.

c. The continuation of the central vital functions or the critical vital func tions: Among these I count the circulatory-respiratory functions but even more those essential elements of biological life characterizing the human body as such, such as metabolism, the immune system, respiration, regener ation and healing, reproduction (production of sperm and ova), etc.

d. "Functions and dynamisms" ordered to an entelechial end: when we are faced with an "integrated function" ordered to a meaningful end of un folding the *entelechy* of the organism, we need to assume the presence of life of the human organism.

e. Presence of life in those parts of the human body which we can regard as indispensable or even sufficient for the incarnate presence of the human soul, as opposed to life in some isolated organs and bodily limbs as in feet or hands, which can be clearly removed without dissolving the body/soul unity: obviously, there is a great difference between parts and functions of the human body which are dispensable in the sense that we can survive their loss, such as our limbs, and other parts and functions which to lose kills us. The difficult question remains: what exactly is this 'indispensable' part or set of functions within the human body without which we cannot live? The candidate for this criterion proposed by the 'brain death' adherents is the brain and neocortex. Even if the whole rest of the body were dysfunctional, we would assume the presence of human life as long as the brain is func tioning. On the other hand, the plasticity of the brain, early embryonic de velopment prior to brain-formation, and other facts forbid us to believe that the presence of the human soul in the body is bound to brain function and can be solely linked to the brain; and therefore it would also be theoretical ly quite possible, if we assume the fiction of a complete brain transplant, that if the brain of person A were transplanted and implanted into another body of person B, this brain would not be linked to the soul of person A but now serve that person B. This certainly happens with the partial brain implanta tions we know.

Negatively speaking, and as a logical consequence of the aforesaid, in or- der to declare a patient dead, all the mentioned six signs and criteria of the presence of human life must be absent. The absence of one or more of these

criteria is not enough. To demand the presence of the three elements of consciousness, integration, and circulatory function is too comprehensive a de- mand in the light of our results. For example, consciousness is not necessary for human life - as early embryonic life as well as unconscious comatose con- ditions prove. Even irreversible unconsciousness per se does not signify death. For life lies deeper than consciousness and while human conscious- ness necessarily entails human life, human life does not entail necessarily con- sciousness, as even sleep tells us. On the other hand, the presence of human consciousness is for itself alone a sufficient criterion for the presence of hu- man life and does not depend on the presence of integration as the cases dis- cussed above show. Similarly, we cannot recognize reactivity to external stim- uli (although it is present to some extent also in brain dead patients) as a nec- essary condition of organic life, for in a frozen embryo or in some states of total paralysis of conscious patients any such reactivity may be absent and still life be present.

2. *Epistemological and Tutioristic Aspects and New Objections*

We can also object against the identification of 'brain death' with the death of the human person by pointing at the following epistemological facts which are simultaneously ethically very significant:

a. *Argument from Evidence Against Brain Death Being Death*: a strong argument proceeds from the strong evidences *against* any identification of 'brain death' with death given above.

b. *Argument from ethical tutiorism*: even if it were objectively true that 'brain death' is really death, it would still not be legitimate to act on this assumption because, to say the least, we do not know with any moral or other certainty that this is so. We are dealing here not only with a lack of mathematical or metaphysical absolute certainty but with an absence of objective moral certainty as well. Moreover, since the acts performed on the diagnosis of 'brain death', namely the extraction of vital organs, would cause death and thus constitute manslaughter or murder, we are absolutely forbidden to perform them.

We have to act even when we are less than indubitably certain about what is the best thing to do. But there are certain actions which we must not com- mit when we do not possess morally indubitable knowledge, such as actions which will kill a person if he or she is not dead. If it turns out impossible to

reach moral certainty about the death of 'brain-dead' individuals, a position which acknowledges the degree of moral certainty required by the specific nature of a given action demands that we refrain from actions which risk killing a human person.

Recognizing the distinction between mathematical-metaphysical certain- ty and moral certainty, we must say? We do not possess any moral certainty, not even a moral probability, that 'brain death' is actually death. As a matter of fact, both the theoretical philosophical arguments sketched above and the practical difficulties of diagnosis of 'brain death' prove that no well-founded moral certainty as to the actual death of 'brain-dead' individuals is available.

In addition, different kinds of action demand different degrees of moral certainty. Even a low moral probability of success can suffice to justify or even renders obligatory an action which might save a life. *To commit an action which risks killing a person, however, takes the highest degree of moral cer- tainty, which we definitely do not possess here.* And such a certainty is not on- ly completely absent in the case of 'brain death' but all the evidence points in the opposite direction. *Therefore even if the defenders of the 'brain death' de- finitions were theoretically right, they would still be morally wrong*.

Many laws forbid absolutely the killing of a being of which we have at least no moral certainty excluding that he might be a living human being. The mere probability and plausibility of there being a human person present is sufficient to forbid morally and legally to kill such a being.

III. *The Empirical Argument from the Doubts about the Concrete Diagnosis of Brain Death either because of Possible Sources of Incorrect Diagnosis or because of the Self-fulfilling Elements of the Diagnosis of Death*

Most defenders and even many opponents of brain-death definitions agree that concrete mistakes in the *medical diagnosis of the state called 'brain death'* are extremely rare and well-nigh impossible. There are, however, at least four ways, some of which are wholly uninfluenced by medical technical competence, in which false diagnoses of 'brain death' can be arrived at:

1. It is possible or even frequently the case that some parts of the diagnosis of 'brain death' actually bring death about. In this conference we will hear an interesting paper on self-fulling elements in the apnea test that can give rise to death instead of observing its having occurred. There is no need to repeat this argument.

2. It is widely recognized that doctors who are interested in transplantations may be easily influenced in their diagnoses of 'brain death' in concrete cases by their own or their colleagues' practical purposes. For this reason most laws and ethical medical codes demand that the operating transplantation team and the examiners of the state of 'brain death' be not identical. But this measure is in no way enough to exclude error that may result from many sources such as friendships between phisicians, etc.

3. Widely discussed incidents of patients who awoke from 'brain death' have led to an intense discussion, and for a time to a virtual cessation, of organtransplants. Such cases are well documented and to some extent implied by the interesting results of Coimbra's and Watanabe's contributions to this conference. Rigorous research and its findings show that "only 35% [of the surveyed physicians responsible for identifying 'brain-dead' patients and declaring them dead] both knew the whole-brain criterion of death and were able to apply it correctly to identify the legal status of patients A and B." This means that more than 60% of all examiners of 'brain death' neither know the criteria well nor apply them correctly. Hence in principle up to 65% of 'brain death' diagnoses might be incorrect. (Even if there were no more fundamental reasons against identifying 'brain death' with death, this reason alone should suffice to put a halt to using 'brain death' criteria until an acceptable percentage of the staff can understand and apply them correctly).

4. It is doubtful whether the complete cessation of all cortical activity or of all brain stem activity can be proven as long as the human organism as a whole lives. It is even more doubtful whether the irreversible cessation of all cortical activity can be secured with moral certainty sufficient not to risk committing manslaughter when killing the 'living corpse' of a 'brain-dead' human being under the insufficiently founded assumption that he is dead.

All the refined, revised and corrected criteria do not even prove the de- cisive point of 'brain death', namely the actual and irreversible cessation of brain activity in all those modules and neurons the activity of which is di- rectly associated with consciousness. Yet this is the center of the medical condition referred to as neocortical death or total brain-infarction and 'whole-brain death'.

5. Furthermore, as long as the very definition of the medical state of 'brain death' is unclear, one cannot devise any method adequate to confirm 'brain death'. Even if the medical condition of 'brain death' were clearly de fined, and if the presence of this state in the concrete case were established

beyond the shadow of a doubt, the actual death of a man because of this condition would not have been verified concretely. This is simply the con- sequence of the discussed lack of adequate theoretical reasons which would prove that the medical condition designated as 'brain death' coincides with actual death.

IV. *The Moment of Death - 'Calculable Problem' or Mystery?*

To declare death as soon the first undoubted marks of death set in, for ex- ample when the heart stands still and all attempts to resuscitate its activity fail, is not presumptuous. Yet to act or to dissect a corpse on the first decla- ration of clinical death is presumptuous. It is much more pretentious, how- ever, to determine the occurrence of death by means of a mere set of scien- tific facts, while the body as a whole, the body qua organism, still lives. Since human death, by its own objective essence, consists in the mystery of the end of that union of life, soul and body which constitutes personal human life, it becomes quite unjustifiable to declare, in terms of various 'brain death' cri- teria of external and philosophically irrelevant nature, that the death of the individual who is biologically alive has occurred prior to the occurrence of ir- reversible clinical death.

Thus we are led to the conclusion that the 'brain death' definition of hu- man death ought to be rejected by any legal and medical code and that its in- troduction by many states lacks a sufficient philosophical basis. In the light of philosophical considerations about life and death the criterion of 'brain death' must even be dismissed as an aberrant new definition of death.

Hence I strongly advocate the position that a metaphysical notion of death as the separation of the soul from the body has to guide our action, in that any reasonable doubt as to its occurrence must forbid operations which might bring it about.

As to the medical concept of death or of its basic signs, I defend the no- tion that death has occurred when "a complete and irreversible cessation of all central vital functions (including cardio-respiratory activity and total brain infarction)" has taken place. I argue not in favor of conceivably limited and outdated notions of clinical death (from which awakening is possible) but de- fend just the datum of death which begins with irreversible cardiac-pul- monary arrest and is often designated as 'clinical death' in which notion the essence and the signs of death, as well as epistemological and ontological cat-

egories merge and are somewhat confused. This notion of an 'irreversible clinical death' corresponds to the classical medical criteria of death which, prior to 1968, were universally accepted.

Death is a fundamental event and datum that must not be arbitrarily re- defined. Every layperson knows the main signs and consequences of this ac- tual death. I argue for a critical return to the *datum* of the 'simple natural event' of death and against the sophistry of dissolving the unity of personal and biological human life or of reducing it to partial aspects.

The question "what is death?" is, moreover, not a matter of 'normative convention' but of finding what it truly is. As A.M. Capron says: "Calling a person dead does not make him dead."[1] I must discover the nature of man and of his biological and personal life and being. Only from this perspective of the truth about man and human life can I determine the objective nature of death and the criteria by means of which death can be ascertained.

The only acceptable medical criterion for personal human life, we con- clude, is biological human life - i.e. life of a human organism, as it exists from conception on. Accordingly, the only acceptable criteria for death are the ir- reversible end of the biological vital functions of the 'organism as a whole', of the body as such.

What are the reasons for this proposal?

A. In the first place, all the other definitions and criteria of man's death are arbitrary, disputable, and ambiguous, while the end of biological human life is a non-arbitrary, non-disputable, and unambiguous criterion of human death.

B. Secondly, it is at least 'unsafe' to take the organs from a 'brain-dead' but otherwise biologically living being. The mere probability of a human per son being present and the absence of moral certainty of his death make it morally and legally wrong to kill him.

C. Thirdly, the best theoretical understanding of man commends the cri terion of biological human life as indicator of personal human life - in view of the unity of body and soul and of the human being as a whole.

One also has to cease regarding this matter as an issue to be resolved by medical scientists primarily. It is decisive that it be recognized that the key is- sue at stake in the 'brain death' discussion is purely philosophical, not med- ical. Persons who agree on all medical facts and evidences disagree on this is- sue for purely philosophical or religious reasons.

[1] A.M. Capron, in "American Medical News," April 17, 1987, p. 1.

V. *Postface on Papal Teaching regarding 'brain death'*

1 wish to add a short comment on the doubts regarding any critique of the notion of 'brain death' that are raised by those who heard or read the address His Holiness Pope John Paul II gave to the 18th International Congress of the Transplantation Society, August 29, 2000.[2] They ask me as a Catholic thoroughly devoted to the Pope: "Is your position not against Church teaching?" I would answer this objection as follows:

a. There is not yet any official Papal or other Church teaching on 'brain death'. There is only a Papal address to transplantation surgeons about this question. There are, however, degrees of the reverence and obedience we owe as Catholics to Papal teaching: not each address of a Pope is infallible teach ing of the Church; only dogmas are. Moreover, the thoughts and judgments expressed in Papal speeches do not possess the same magisterial rank of the-ordinary Papal Magisterium as Encyclicals, Papal Exhortations and others. Therefore, while any Papal address merits our deep respect and openness to any truth it teaches us, a Papal address is no dogma nor an official Church document, and therefore open to discussion.

b. From the speech of Pope John Paul II it is evident that he repeats, as supreme moral teacher of the Catholic Church, the classical ethical doctrine that if it is in any way doubtful whether a human person is still alive, one must treat her as a living person.

c. Therefore (on the background of this permanent Church Teaching) the Pope's conclusions about 'brain death' being a viable and acceptable defini tion and basis of human action, can only be based on a the second empirical premise that expresses a kind of knowledge that is never itself a possible con tent of Church Teaching but is received by any Pope from outside sources (statistics, scientific journalism, other information), namely that 'brain death' definitions have become objects of a universal consensus of the medical com munity, an information that clearly turns out to be a wrong empirical infor mation. The conclusion that we may legitimately act on the basis of 'brain death' definitions and criteria (extracting organs from the 'brain dead') de pends on this premise. If it is wrong, the conclusion is wrong as well.

[2] John Paul II, *Address of 29 August 2000 to the 18th International Congress of the Transplanta tion Society*, in "L'Osservatore Romano," Vatican City, August 2000, p. 1-2 (www.vatican.va/holy_father/john_paul_ii/speeches/2000/jul-sep/documents/hf_jp-ii_spe_20000829_transplants_en.html).

d. But the empirical premise underlying this conclusion turns out to be a wrong empirical information. Many books, speeches, and documents – such as many of those published by the participants of this conference, the Pro ceedings of the Second[3] to the Fourth International Symposium on Coma and Death, in Havana, Cuba[4] (1996, 2000, and 2004), the new book edited by Italian scholars Rosangela Barcaro and Paolo Becchi,[5] and many other documents – show that there is a widespread doubt and growing conviction that 'brain death' is not death among some of the finest scientists, philoso phers, and theologians and among persons of such different world-views as Peter Singer and Robert Spaemann.

e. Therefore the logical conclusion to be drawn from the very speech of the Pope and from the true and evident ethical principle stated in it (empha sized by the whole Church tradition of moral teachings), that even if a small reasonable doubt exists that our acts kill a living human person, we must ab stain from them, if joined to the fact of the growing uncertainty in the scien tific, legal, psychological, and philosophical community world-wide about whether 'brain death' is actual human death, is the following: 'Brain death' definitions must not be accepted as ground of acts of explantation of vital hu man organs given, to say no more, the great uncertainty of this hypothesis.

[3] *Brain death. Proceedings of the Second international Conference on Brain Death, Havana, Cu ba, February 27-March 1, 1996*, edited by C. Machado, Amsterdam, Elsevier, 1995.
[4] *Brain death and disorders of counsciousness*, edited by C. Machado and D.A. Shewmon, New York, Kluwer Academy/Plenum Publishers, 2004.
[5] *Questioni mortali. L'attuale dibattito sulla morte cerebrale e il problema dei trapianti*, edited by R. Barcaro and P. Becchi, Napoli, Edizioni Scientifiche Italiane, 2004.

Brain-Body Disconnection: Implications for the Theoretical Basis of 'Brain Death'[*]

D. ALAN SHEWMON

I. *Statement of the Problem*

That death of the brain constitutes death of the patient has been widely accepted in the medical and legal professions throughout the world[1]. It is re- markable, however, that in the last decade or so, the various position state- ments and official commentaries on 'brain death' by neurological and other medical societies have failed to state *why* they equate 'brain death' with the death of the individual. The same can be said for many recent books and chapters by neurologists on the subject. The equivalence is simply taken for granted as common knowledge, and the discussions focus rather on details of the diagnostic criteria, how high the pCO2 must be for a valid apnea test, sensitivity and specificity of various confirmatory tests, etc.

The American Academy of Neurology, for example, in its 1995 *Practice Parameters for Determining 'Brain Death' in Adults*[2], which still remain the gold-standard diagnostic criteria in the United States, did not offer a single reason why it considers death of the brain to be death. Neither did Dr. Eel- co Wijdicks in his accompanying commentary on the *Practice Parameters*[3] or in the chapter on 'brain death' in his book on critical care neurolo-

* Adapted from a paper prepared for the conference on the "Signs of Death," The Pontifical Academy of Sciences, Vatican City, September 11-12, 2006.

[1] E.F.M. Wijdicks, *Brain death worldwide: accepted fact but no global consensus in diagnostic criteria*, in "Neurology," 58, 2002, p. 20-25.
[2] American Academy of Neurology - Quality Standards Subcommittee, *Practice parameters for determining brain death in adults (Summary statement)*, in "Neurology," 45, 1995, p. 1012-1014.
[3] E.F.M. Wijdicks, *Determining brain death in adults*, in "Neurology," 45, 1995, p. 1003-1011.

gy[4]. Nor, in his recent book on brain death[5], does he state why he himself be- lieves 'brain death' to be death; rather, that apologetic task was delegated to Dr. James Bernat, who has become somewhat of the unofficial 'brain-death'- theory spokesperson for mainstream neurology in the United States (not without good reason), in whose chapter only a single paragraph is devoted to answering what he himself characterizes as "the most serious challenges thus far to the 'brain death' concept" (namely my publications as of that time)[6]. Neither does Dr. Allan Ropper, in the sections on 'brain death' in his two widely read textbooks, state why he considers 'brain death' to be death[7]. Nei- ther did the Working Group of the Royal College of Physicians[8] or earlier the Task Force for the Determination of 'Brain Death' in Children[9]. I dare say that doctors in general, and neurologists in particular, have come to an overwhelming consensus that 'brain death' is death, not because they have examined the evidence and concluded it for themselves, but purely and simply from a professional herd mentality. When queried about it, few can give a coherent explanation why 'brain death' is death itself, as opposed to deep coma in a dying patient. In a revealing survey of physicians and nurses involved in transplantation, who surely ought to have a solid under- standing of 'brain death' for the sake of their own consciences, 58% did not use a coherent concept of death consistently and 19% held a concept of death that would logically classify patients in a persistent vegetative state as dead[10].

[4] E.F.M. Wijdicks, *The Clinical Practice of Critical Care Neurology*, Oxford, Oxford Universi ty Press, 2003, 2nd ed., p. 547-562.
[5] *Brain Death*, edited by E.F.M. Wijdicks, Philadelphia, Lippincott Williams & Wilkins, 2001.
[6] J.L. Bernat, *Philosophical and ethical aspects of brain death*, in *Brain Death*, edited by E.F.M. Wijdicks, p. 171-187 (p. 180).
[7] A.H. Ropper, R.H. Brown, *Adams and Victor's Principles of Neurology*, New York, McGraw- Hill, 2005, 8° ed., p. 306-307, 961-962; A.H. Ropper, D.R. Gress, M.N. Diringer et al., *Neurolog ical and Neurosurgical Intensive Care*, Philadelphia, Lippincott Williams & Wilkins, 2004, 4° ed., p. 157-164.
[8] Working Group of the Royal College of Physicians, *Criteria for the diagnosis of brain stem death, Review by a Working Group convened by the Royal College of Physicians and endorsed by the Conference of Medical Royal Colleges and their Faculties in the United Kingdom*, in "Journal of the Royal College of Physicians," 29, 1995, p. 381-382.
[9] Task Force for the Determination of Brain Death in Children, *Guidelines for the determina tion of brain death in children*, in "Annals of Neurology," 21, 6, 1987, p. 616-617.
[10] S.J. Youngner, C.S. Landefeld, C.J. Coulton et al., *'Brain death' and organ retrieval. A cross- sectional survey of knowledge and concepts among health professionals*, in "Journal of the American Medical Association," 261, 1989, p. 2205-2210.

II. *Four Candidate Rationales for Equating 'Brain Death' with Death*

Across the half-century of 'brain death' history up to the present, the many proposed reasons for equating death of the brain with death of the in- dividual have fallen into four basic categories:

1. *because* death is not an objective physical state but a relativistic legal definition or custom based on what seems most useful to a given society at a given time (*societal relativism*); or

2. *because* the brain is the organ of the mind, which is the essence of the person; therefore, the irreversible cessation of mind is cessation (death) of the person (*person/mind reductionism*); or

3. *because* the brain is the central integrating organ of the body, so that without brain function the body ceases to be a unified biological organism and begins the irrevocable process of disintegration (somatic integration rationale); or

4. *because* the permanent loss of *both* mental functions *and* bodily unity, attendant upon death of the brain, constitutes "the total disintegration of that unitary and integrated whole that is the personal self"[11] (*psychosomatic integration rationale*).

A fifth rationale is not listed, because it is only a pseudo-rationale, name- ly the "fatal lesion fallacy" ('brain death' is death because it will imminently lead to death). Remarkably, some experts still offer this as an implicit ratio- nale for 'brain death'. (e.g., Wijdicks: "In the United States, primary brain- stem death does not fit into the concept of whole 'brain death', but it has been accepted in the United Kingdom and rightly so, because no survivor has been reported when all brainstem function has been lost.")[12]

There are no other broad categories of proposed reasons why death of the brain as an organ should constitute death of the individual person. Let us now examine these four rationales in somewhat greater detail.

(1) Societal relativism was the rationale of, among others, Dr. Henry Beecher, chairman of the Harvard Committee, as made clear in some of his commentaries following the revolutionary Harvard Committee Report of

[11] John Paul II, *Address of 29 August 2000 to the 18th International Congress of the Transplan tation Society*, in "L'Osservatore Romano," Città del Vaticano, August 2000, p. 1-2 (www.vatican.va/holy_father/john_paul_ii/speeches/2000/jul-sep/documents/hf_jp-ii_spe_20000829_transplants_en.html).

[12] E.F.M. Wijdicks, *Clinical diagnosis and confirmatory testing of brain death in adults*, in *Brain Death*, edited by E.F.M. Wijdicks, p. 61-90 (p. 76).

1968,[13] which marked the beginning of the general acceptance of 'brain death' as death:

At whatever level **we *choose* to call death**, it is an **arbitrary** decision. Death of the heart? The hair still grows. Death of the brain? The heart may still beat. The need is **to choose** an irreversible state where the brain no longer functions. It is best **to choose** a level where, although the brain is dead, usefulness of other organs is still present.[14]
Here we **arbitrarily** accept as death, destruction of one part of the body; but it is the supreme part, the brain.[15]
Can society afford to discard the tissues and organs of the **hopelessly uncon- scious patient** so greatly needed for study and experimental trial to help those who can be salvaged?[16]

Needless to say, *societal relativism* is incompatible with any sort of ob- jective metaphysics of life and death, and as such is incompatible with the fundamental tenets of many of the world's religions.

> *(2) Person/mind reductionism* declares the person to be dead when there is no longer a personal mind or consciousness, even in potency (e.g., excluding states of sleep or coma from which there is a potential to awaken; whether human embryos are excluded or not varies across authors). According to this view, truly irreversible coma, as well as permanent vegetative state (defined according to the American Academy of Neurology and many other professional societies in terms of unawareness of self and environment)[17] are therefore death of a person, regardless of the biological life/death status of the (former) person's body (also prescinding here from the subtle controversies surrounding the terms "irreversible" and "permanent."[18] This rationale is

[13] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death*, in "Journal of the American Medical Association," 205, 1968, p. 337-340.
[14] H.K. Beecher, H.I. Dorr, *The new definition of death. Some opposing views*, in "Int. J. Clin. Pharmacol.," 5, 1971, p. 120-124 (p. 120).
[15] Ibid., p. 121.
[16] Ibid., p. 122.
[17] D.A. Shewmon, *The ABC of PVS: problems of definition*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, New York, Kluwer Academic/Plenum Publishers, 2004, p. 215-228; D.A. Shewmon, *A critical analysis of conceptual domains of the veg etative state: Sorting fact from fancy*, in "NeuroRehabilitation," 19, 2004, p. 343-347.
[18] D.J. Cole, *The reversibility of death*, in "Journal of Medical Ethics," 18, 1992, p. 26-30 (see also discussion p. 31-33); J.P. Lizza, *Potentiality, irreversibility, and death*, in "Journal of Medicine

frequently referred to in the literature as the "higher brain" formulation of 'brain death'. It has had and continues to have many advocates.

It is no secret that the philosophical world-view of most scientists today is material monism: only matter-energy exists, and all talk of any sort of spir- itual "soul" is meaningless nonsense, a holdover from previous ages of un- scientific religious credulity. The fact that the brain is the organ of the mind, in this world-view, therefore translates necessarily to the thesis that the hu- man mind is totally the product of physical brain activity (mysterious as that may be). Thus, most scientists today, and especially neuroscientists, are not only *person/mind reductionists*, but person/mind/brain reductionists, so that permanent unconsciousness from a brain lesion constitutes cessation of personal existence. Perhaps the most succinct statement of such reduction- ism is to be found in the chapter on 'brain death' in Plum and Posner's in- fluential textbook The Diagnosis of Stupor and Coma: "Agreement that the brain and the person are one has essentially removed the ethical conflict that otherwise derives from the almost universal respect for the dignity of the in- dividual human being."[19]

By contrast, according to a more traditional philosophical anthropology, the fact that proper mental functioning depends on the instrumentality of the brain translates rather to an interpretation of permanent unconsciousness as a severe mental disability, a paralysis of a person's psychological functions, but not an annihilation of the person, so long as the human organism remains biologically unified and alive. Permanent coma is not an oxymoron.

(3) *Somatic and*

(4) *psychosomatic integration.* Both of these rationales stand or fall on whether a developed human body (embryos and fetuses excepted) requires somatically integrative brain function to remain a unified biological organism, totally apart from the brain's role in mental functioning. In the 1970s and '80s this presumed physiologically integrating role of the brain was almost universally cited as a well established medical "fact" by 'brain death' apologists (e.g., the U.S. President's Commission,[20] the Swedish Commit-

and Philosophy," 30, 2005, p. 45-64; J.P. Lizza, *Persons, Humanity, and the Definition of Death*, Baltimore, Johns Hopkins University Press, 2006, p. 102-107; T. Tomlinson, *The irreversibility of death: reply to Cole*, in "Kennedy Institute of Ethics Journal," 3, 1993, p. 157-165.

[19] F. Plum, J.B. Posner, *The Diagnosis of Stupor and Coma*, Philadelphia, F.A. Davis Compa ny, 1983, 3rd ed. (3rd printing), p. 325.

[20] President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: Medical, Legal, and Ethical Issues in the Determination of Death*, Washington, DC, U.S. Government Printing Office, 1981.

tee,[21] and the two Working Groups of the Pontifical Academy of Sciences).[22] Despite increasing challenges by new clinical and theoretical counterevi- dence over the last 10 years, many still cling to the somatically integrating role of the brain as a fundamental reason why brain death is supposedly death (whether the only fundamental reason as in the somatic integration ra- tionale, or one of two fundamental reasons - both necessary - as in the *psy- chosomatic integration rationale*).

It was precisely the emergence of impressive counterevidence to this sup- posed medical "fact" that caused me in the early 1990s to reverse my earlier position defending 'brain death' as death.[23] Over the last 10 years an in- creasing number of 'brain death' commentators, including both advocates and critics of 'brain death' as death, have rejected the somatic-integration thesis as no longer tenable. The October 2001 issue of "Journal of Medicine and Philosophy" was devoted entirely to the topic of 'brain death'. In the preface, the issue editor acknowledged being convinced by my lead article[24] that "[e]quating 'brain death' with loss of somatic integrative function, while useful for clinical, transplant, and policy purposes, is physiologically inaccu- rate and theoretically incoherent."[25] Moreover, the other authors, spanning a broad spectrum of philosophical and ethical opinions surrounding 'brain

[21] Swedish Committee on Defining Death, *The concept of death. Summary*, Stockholm, Swedish Ministry of Health and Social Affairs, 1984.

[22] C. Chagas, *Conclusions*, in *Working Group on the Artificial Prolongation of Life and the De termination of the Exact Moment of Death. October 19-21, 1985*, edited by C. Chagas, Vatican City, Pontifical Academy of Sciences, 1986, p. 113-114; R.J. White, H. Angstwurm, I. Carrasco de Paula, *Final considerations formulated by the scientific participants*, in *Working Group on the Determina tion of Brain Death and its Relationship to Human Death. 10-14 December, 1989*, edited by R.J. White, H. Angstwurm, I. Carrasco de Paula, Vatican City, Pontifical Academy of Sciences, 1992,
p. 81-82.

[23] D.A. Shewmon, *The metaphysics of brain death, persistent vegetative state, and dementia*, in "The Thomist," 49, 1985, p. 24-80; D.A. Shewmon, *Caution in the definition and diagnosis of in fant brain death*, in *Medical Ethics: A Guide for Health Professionals*, edited by J.F. Monagle and
D.C. Thomasma, Rockville, MD, Aspen, 1988, p. 38-57; D.A. Shewmon, *'Brain death': a valid theme with invalid variations, blurred by semantic ambiguity*, in *Working Group on the Determina tion of Brain Death and its Relationship to Human Death. 10-14 December, 1989*, edited by R.J. White, H. Angstwurm, I. Carrasco de Paula, p. 23-51; D.A. Shewmon, *Recovery from 'Brain Death': A Neurologist's Apologia*, in "Linacre Quarterly," 64, 1997, p. 30-96.

[24] D.A. Shewmon, *The brain and somatic integration: insights into the standard biological ra tionale for equating "brain death" with death*, in "Journal of Medicine and Philosophy," 26, 2001,
p. 457-478.

[25] A B. Lustig, *Theoretical and clinical concerns about brain death: the debate continues*, in "Journal of Medicine and Philosophy," 26, 2001, p. 447-455 (p. 448).

death', acknowledged being convinced that the brain-dead body is after all a living human organism.[26] The same conclusion is accepted by most "higher 'brain death'" advocates[27] and other thoughtful critics of 'brain death' or- thodoxy.[28]

At the Third International Symposium on Coma and Death, in Havana, Cuba, February 22-25, 2000, I gave a keynote address,[29] which in philosopher John Lizza's opinion "delivered on [my] claim to 'drive the nails into the cof- fin' of the idea that organic integration requires brain function."[30] During the question-and-answer session Dr. Fred Plum himself, 'brain death' expert and first author of the important textbook *The Diagnosis of Stupor and Coma*,[31] stood up and said in essence, "OK, I'll grant you that the brain-dead body is a living human organism, but is it a human person?" At which he proceeded to propound person/mind/brain reductionism as the real reason why 'brain death' is death, insisting that the biological life/death status of the body is philosophically and ethically irrelevant.

It is not mere carelessness when prominent neurologists and neurosur- geons drop "Freudian slips" regarding the life/death status of the brain-dead body, implying agreement with Dr. Plum's comment at the Cuba symposium.

Dr. Albrecht Harders, neurosurgeon: "Transcranial Doppler findings were obtained in 15 patients who fulfilled the clinical criteria for 'brain

[26] F.T. Dagi, R. Kaufman, *Clarifying the discussion on brain death*, in "Journal of Medicine and Philosophy," 26, 2001, p. 503-525; A. Halevy, *Beyond brain death?*, ibid., p. 493-501; M. Potts, *A requiem for whole brain death: a response to D. Alan Shewmon's 'The brain and somatic integration'*, ibid., p. 479-491; S.J. Youngner, R.M. Arnold, *Philosophical debates about the definition of death: Who cares?*, ibid., p. 527-537.

[27] J.P. Lizza, *Persons, Humanity, and the Definition of Death* (p. 14); J.F. Spittler, *Gehirn, Tod und Menschenbild. Neuropsychiatrie, Neurophilosophie, Ethik und Metaphysik*, Stuttgart, W. Kohlhammer, 2003, p. 91-92; R.M. Veatch, *The death of whole-brain death: the plague of the dis- aggregators, somaticists, and mentalists*, in "Journal of Medicine and Philosophy," 30, 2005, p. 353- 378.

[28] *Beyond Brain Death. The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, Dordrecht, Kluwer Academic Publishers, 2000; R.D. Truog, *Is it time to abandon brain death?*, in "Hastings Center Report," 27, 1, 1997, p. 29-37.

[29] D.A. Shewmon, *The 'critical organ'for the organism as a whole: lessons from the lowly spinal cord*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 23-41.

[30] J.P. Lizza, *The conceptual basis for brain death revisited: loss of organic integration or loss of consciousness?*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 51-59 (p. 52).

[31] F. Plum, J.B. Posner, *The Diagnosis of Stupor and Coma*, Philadelphia, F. A. Davis Compa ny, 1983, 3rd ed. (3rd printing).

death'… All of the patients **died** within 24 hours or upon discontinuation of the mechanical ventilation."[32]

Dr. Allan Ropper, intensive care neurologist: "Dr. Ropper added that it has been suggested that children who are brain dead **can be kept alive** by artificial means for a long period of time, but this is not true in adults."[33] (We may give Dr. Ropper the benefit of the doubt that this was a misquotation on the part of the medical reporter; it is nevertheless provocative that that was the impression the reporter came away with). Of greater interest are the words Dr. Ropper and colleagues themselves chose, in their popular textbook Principles of Neurology, to describe long- surviving cases of 'brain death': "In exceptional cases, however, the provision of adequate fluid, va-sopressor, and respiratory support allows **preservation of the somatic organism in a comatose state** for longer periods."[34] This is precisely my thesis, that these patients are indeed comatose human organisms.

Dr. Fred Plum, neurologist. In a book chapter published in 1999, Table 2.4 is entitled "Prolonged Visceral Survival after 'Brain Death'," the fifth col- umn of which has the heading **"Mode of Death."**[35] Included in this column are entries of either "spontaneous cardiac arrest" or "respirator discontin- ued," implying that these patients were *not* dead by virtue of the 'brain death', which had taken place from 26 to 201 days before, but by virtue of the circulatory-respiratory arrest. Later in the same chapter, regarding a se- ries of 73 brain-dead patients, Plum wrote: "half experienced asystole by the third day but the bodies of 2 **lived on** until the 10th and 16th day."[36]

The late Dr. Ronald Cranford, long-time chairman of the Ethics Com- mittee of the American Academy of Neurology and prominent expert on 'brain death', was more forthright in not only his own endorsement of per- son/mind/brain reductionism, but even in opining that this was the ultimate, though tacit, conceptual driving force behind the widespread acceptance of 'brain death' in the 1970s: "It seems then that permanently unconscious pa-

[32] A. Harders, *Neurosurgical Applications of Transcranial Doppler Sonography*, New York, N Y, Springer-Verlag, 1986, p. 115.

[33] Quotation in A. Goodman, *Brain death: agreement on the concept but not the determination procedures*, in "Neurology Today," 2, 3, 2002, p. 7.

[34] A.H. Ropper, R.H. Brown, *Adams and Victor's Principles of Neurology*, p. 962.

[35] F. Plum, *Clinical standards and technological confirmatory tests in diagnosing brain death*, in *The Definition of Death: Contemporary Controversies*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, Baltimore, MD, Johns Hopkins University Press, 1999, p. 34-65 (p. 38).

[36] Ibid., p. 53.

tients have characteristics of both the living and the dead. It would be tempt- ing **to call them dead and then retrospectively apply the principles of death, as society has done with 'brain death.' "**[37] I am indebted to Dr. Cranford for his bringing to my attention certain cases of prolonged survival in 'brain death' and for his candid editorial commentary to my 1998 article on "chronic 'brain death'," [38] in which he agreed with my conclusion that these bodies are biologically living organisms, although he opined that this is ethically irrelevant because they are still dead as human beings.[39]

My impression from many Socratic conversations with colleagues on this issue is that most neurologists and physicians in general, when probed and pressed for a coherent rationale why 'brain death' is death, regardless what rationale they may offer at the beginning of the conversation, will ultimately end up saying something like Dr. Plum did in Havana: "OK, I'll grant you that the brain-dead body is a living human organism, but is it a human per- son?" Nevertheless, "cessation of the organism as a whole" still remains the tacit, semi-official rationale for 'brain death' in most countries.

III. *'Brain Death' as "Physiological Decapitation"*

In the effort to explain why 'brain death' is death, authors of all persua- sions have often made use of an analogy with decapitation, according to seemingly straightforward syllogistic reasoning:

1. A decapitated person is dead.
2. Brain death is physiologically equivalent to decapitation.
3. Therefore, a brain-dead person is dead.

I must preface this discussion with an apology for the distastefulness of the topic at a time when beheading is no mere historical curiosity of the French revolution, but a current and barbaric form of terrorism carried out on innocent hostages, sometimes even slowly and piecemeal in order to max- imize the agony and the horror of it. Out of respect for these victims and their loved ones, I would prefer not to deal with the topic here in writing. Never-

[37] R.E. Cranford, D.R. Smith, *Consciousness: the most critical moral (constitutional) standard for human personhood*, in "American Journal of Law and Medicine," 13, 2-3, 1987, p. 233-248.

[38] D.A. Shewmon, *Chronic "brain death": meta-analysis and conceptual consequences*, in "Neu rology," 51, 1998, p. 1538-1545.

[39] R.E. Cranford, *Even the dead are not terminally ill anymore (editorial)*, in "Neurology," 51, 1998, p. 1530-1531.

theless, a thorough re-evaluation of 'brain death' orthodoxy is now very timely and necessary, and it cannot be done without addressing in depth the validity and explanatory utility of this traditional and powerful analogy. Therefore, I shall proceed, trying to keep the discussion as hypothetical as possible, but with a reverent awareness that some aspects of the analogy are sadly all too real.

III. A. *Utilization of the analogy by advocates of whole-brain, brainstem, and higher 'brain death'.*

The analogy must get at something fundamental and important about the essence of 'brain death', since it has been utilized by all three of the major competing 'brain death' camps: "whole brain," "brainstem," and "higher brain."

Among whole-brain advocates, nothing less than the U.S. President's Commission itself wrote: "Contrast such situations [heart or kidney transplants, dialysis, iron lung], however, with the hypothetical of a decapitated body treated so as to prevent the outpouring of blood and to generate respiration: continuation of bodily functions in that case would not have restored the requisites of human life."[40] In the Commission's critique of "higher 'brain death'," it also refers to the analogy: "When the brain processes cease (whether due to decapitation or to 'brain death') the person's identity also lapses."[41] Eighteen years later, the Commission's Executive Director, Alexander Capron, was still citing "physiological decapitation" as "[p]erhaps the easiest way to think of 'brain death.'[42] Dr. James Bernat, one of the most prominent apologists for "whole 'brain death'," began his chapter on philosophical and ethical aspects in Wijdicks' book with a historical reference dating the *Anlage* of modern 'brain death' theory back to observations on decapitation:

The idea that irreversible absence of brain function was the equivalent of death began in the 12th century with the writings of the famous Jewish physician and philosopher Moses Maimonides. Maimonides noticed that decapitated humans ex- hibited muscular twitches for a short time immediately following decapitation. He

[40] President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: Medical, Legal, and Ethical Issues in the Determination of Death*, p. 36.
[41] Ibid., p. 39.
[42] A.M. Capron, *The bifurcated legal standard for determining death: does it work?*, in *The De finition of Death: Contemporary Controversies*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, p. 117-136 (p. 125).

asserted that decapitated humans were dead instantly and that such muscle move- ments were not a sign of life because they lacked the central direction that was in- dicative of the soul.[43]

Within Judaism the "physiological decapitation" analogy of 'brain death' was introduced by Rabbi Dr. Moshe Tendler, citing Talmudic support for it.[44] The validity and consequences of the analogy remain controversial among Jewish authorities, but its importance as a heuristic device is clear.[45]
"Brainstem-death" advocates in the United Kingdom make similar use of the analogy. As far back as 1975, the British medical literature cited decapitation by guillotine as a conceptual aid to understanding the new criterion of death.[46] Philosopher David Lamb in his book on "brainstem death" makes several references to the analogy.[47] A 1996 monograph by Pallis and Harley,[48] one of the most complete and vigorous defenses of "brainstem death," goes so far as to include a photo of an actual execution by decapitation (date and place unidentified), showing a propped-up, sitting, headless body with distinct columns of blood spurting spectacularly into the air. (At least it's in black and white). The caption reads: "Anatomical decapitation. Heart is still beating as shown by jets of blood from carotid and vertebral arteries." The associated text reads:

One type of event epitomizes the fact that death may precede cessation of the heartbeat: decapitation. Once the head has been severed from the neck the heart continues to beat for up to an hour [citing here an 1870 French reference regarding

[43] J.L. Bernat, *Philosophical and ethical aspects of brain death*, *Brain Death*, in *Brain Death*, edited by E.F.M. Wijdicks, p. 171; J.L. Bernat, *Ethical Issues in Neurology*, Boston, Butterworth- Heinemann, 2002, 2nd ed., p. 244.
[44] M.D. Tendler, *Cessation of brain function: ethical implications in terminal care and organ transplant*, in "Annals of the New York Academy of Sciences," 315, 1978, p. 394-397 (p. 395).
[45] Z.H. Rappaport, I.T. Rappaport, *Brain death and organ transplantation: concepts and prin ciples in Judaism*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 133-137 (p. 135); F. Rosner, *The definition of death in Jewish law*, in *The Definition of Death: Contemporary Controversies*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, p. 210- 221 (p. 217-219).
[46] G. Thurston, *The beating-heart cadaver (editorial)*, in "The Medico-Legal Journal," 43, 1975, p. 37-38.
[47] D. Lamb, *Death, Brain Death and Ethics*, Albany, N Y, State University of New York Press, 1985, p. 30, 46, 84.
[48] C. Pallis, D.H. Harley, *ABC of Brainstem Death*, London, BMJ Publishing Group, 1996, 2nd ed.

execution by guillotine]. Is that person alive or dead? If those who hold that a per- son can be truly dead only when the heart has stopped believe that a decapitated per- son is still alive simply because parts of the heart are still beating, they have a con- cept of life so different from ours that we doubt if bridges could be built. The ex- ample given is one of *anatomical* decapitation. Brain death is *physiological* decapita- tion and usually occurs when the intracranial pressure has lastingly exceeded the ar- terial pressure. Nevertheless, the implications of the two types of decapitation are similar. They are that the death of the brain is the necessary and sufficient condition for the death of the individual person.[49]

Advocates of "higher-'brain death'" similarly make good heuristic use of the analogy and all sorts of hypothetical variations on it, such as surgical brain removal, head or brain transplants, partial brain transplants, isolated living brains floating in vats, replacement of parts of the brain with futuristic computer chips, etc. I based my own earlier defense of 'brain death' largely on a thought experiment involving surgical decapitation and technological maintenance of both the isolated head and the headless body.[50] Similar kinds of thought experiments have been used to support a consciousness-based "higher-brain" notion of death by philosophers,[51] ethi-cists,[52] and neurologists.[53]

[49] Ibid., p. 4.
[50] D.A. Shewmon, *The metaphysics of brain death, persistent vegetative state, and dementia*; D.A. Shewmon, *Caution in the definition and diagnosis of infant brain death*, in *Medical Ethics: A Guide for Health Professionals*, edited by J.F. Monagle and D.C. Thomasma.
[51] M. Green, D. Wikler, *Brain death and personal identity*, in "Philosophy and Public Affairs," 9, 1980, p. 105-133 (p. 123-125); J.P. Lizza, *Persons, Humanity, and the Definition of Death*, (p. 28, 107); C. Machado, O.D. García, J.M. Román et al., *Four years after the 'First International Sym posium on Brain Death' in Havana: Could a definitive conceptual re-approach be expected?*, in *Brain Death. Proceedings of the Second International Conference on Brain Death. Havana, Cuba, Febru ary 27-March 1, 1996*, edited by C. Machado, Amsterdam, Elsevier, 1995, p. 1-10 (p. 3-4); D. Wik- ler, *Not dead, not dying? Ethical categories and persistent vegetative state*, in "Hastings Center Re port," 18, 1, 1988, p. 41-47.
[52] S.J. Youngner, E.T. Bartlett, *Human death and high technology: The failure of the whole brain formulations*, in "Annals of Internal Medicine," 99, 1983, p. 252-258 (p. 256).
[53] C. Machado, *Death on neurological grounds*, in "Journal of Neurosurgical Sciences," 38, 4, 1994, p. 209-222 (p. 214); C. Machado, *A new definition of death based on the basic mechanisms of consciousness generation in human beings*, in *Brain Death. Proceedings of the Second International Conference on Brain Death. Havana, Cuba, February 27-March 1, 1996*, edited by C. Machado, p. 57-66 (p. 63-64); C. Machado, *Is the concept of brain death secure?*, in *Ethical Dilemmas in Neu rology*, edited by A. Zeman and L.L. Emanuel, London, W. B. Saunders Company, 2000, p. 193- 212 (p. 206-208); J.F. Spittler, *Gehirn, Tod und Menschenbild. Neuropsychiatrie, Neurophilosophie, Ethik und Metaphysik*, p. 110.

Actual experimental decapitations of animals, with mechanical ventilation and prevention of exsanginuation, have been performed to prove that such thought experiments in humans are in principle physiologically possible. In the Pallis and Harley monograph cited above, on the page facing the decapitation- execution photo, there is a photo of a decapitated chicken standing, with the head lying on the ground at its feet. The text reads:

About 25 years ago a picture of an unsuccessfully decapitated chicken appeared in a leading magazine. The forebrain had been amputated and lay on the ground. The brainstem was still in situ. The animal, still breathing, was photographed some time after the decapitation. Was it alive or dead? In our opinion the animal must be considered alive so long as its brainstem is functioning.[54]

A pregnant sheep was technologically maintained for 30 minutes following decapitation, until a healthy lamb was delivered by Cesarean section.[55] Neurosurgeon Robert White performed experimental head and brain transplants in monkeys to demonstrate the theoretical feasibility of such thought experiments in humans, and made use of these experiments in his arguments justifying 'brain death' as death.[56] Bernard Gert, co-author with Bernat on two important conceptual articles on brain-death,[57] cited these experiments of White in his later independent defense of 'brain death'.[58]

[54] C. Pallis, D.H. Harley, *ABC of Brainstem Death*, p. 5.

[55] A. Steinberg, M. Hersch, *Decapitation of a pregnant sheep: a contribution to the brain death controversy*, in "Transplantation Proceedings," 27, 1995, p. 1886-1887.

[56] R.J. White, *Experimental transplantation of the brain*, in *Human Transplantation*, edited by F.T. Rapaport and J. Dausset, New York & London, Grune and Stratton, 1968, p. 692-709; R.J. White, *A commentary on the extension of human existence and the redefinition of human life and death in terms of brain function*, in *Working Group on the Artificial Prolongation of Life and the De termination of the Exact Moment of Death. October 19-21, 1985*, edited by C. Chagas, p. 57-63; R.J. White, M.S. Albin, J. Verdura, *Isolation of the monkey brain: in vitro preparation and maintenance*, in "Science," 141, 1963, p. 1060-1061; R.J. White, M.S. Albin, J. Verdura, *Preservation of viabili ty in the isolated monkey brain utilizing a mechanical extracorporeal circulation*, in "Nature," 202, 1964, p. 1082-1083; R.J. White, M.S. Albin, G.E. Locke et al., *Brain transplantation: Prolonged sur vival of brain after carotid-jugular interposition*, in "Science," 150, 1965, p. 779-781; R.J. White, L.R. Wolin, L.C. Massopust et al., *Cephalic exchange transplantation in the monkey*, in "Surgery," 70, 1971, p. 135-139.

[57] J.L. Bernat, C.M. Culver, B. Gert, *On the definition and criterion of death*, in "Annals of In ternal Medicine," 94, 1981, p. 389-394; J.L. Bernat, C.M. Culver, B. Gert, *Defining death in theo ry and practice*, in "Hastings Center Report," 12, 1, 1982, p. 5-8.

[58] B.Gert, *A complete definition of death*, in *Brain Death. Proceedings of the Second Interna tional Conference on Brain Death. Havana, Cuba, February 27-March 1, 1996*, edited by C. Macha- do, p. 23-30 (p. 25-26).

What I intend to show in the remainder of this chapter is that, when the "physiological decapitation" analogy is properly dissected down to its essen- tial features, it ironically proves just the opposite of what "whole-brain" and "brainstem" advocates have been using it for. Namely, I will show that the "physiologically decapitated" brain-dead body is *not* equivalent to an anatomically decapitated one, and is just as much a living "organism as a whole" as a body with high spinal cord transection, the difference being that the former is comatose and the latter is conscious – but as far as the physio- logical equivalence goes, they are the same. If the focus of the analogy is on the headless body and its physiology, then the analogy completely backfires on the defenders of "whole-brain" and "brainstem death." If, on the other hand, the focus is on the severed head, consciousness and personal identity, then the analogy has a powerful heuristic value for defenders of "higher 'brain death'." I will argue, however, that the conclusions that can be drawn from thought experiments involving brain-body separation are highly spec- ulative, depend in large part on one's basic philosophical world-view, and in the final analysis are irrelevant to understanding clinical 'brain death', in which no such separation is involved. Michael Reuter, in his recent mono- graph on 'brain death', comes to a similar conclusion about the lack of heuris- tic utility of the decapitation analogy.[59]

III. B. *Focus on the body - Is it still an organism as a whole?*

Let us begin by focusing on the headless body following decapitation, since, after all, that is the part where the "physiology" occurs in "physiolog- ical decapitation."

III. B. 1. *Irrelevance of Exsanguination and Esthetic Considerations*

First I want to quickly dismiss the relevance of references to actual de- capitation-executions (such as mentioned historically by Bernat and sensa- tionalized by Pallis and Harley). Everyone seems to take for granted that a person dies instantly upon execution by guillotine or swift sword swipe (the major premise in the syllogism at the beginning of section III. above). I sug- gest that this assumption is essentially an unreasoned gut-reaction to the emo- tional shock effect: the extreme degree of mutilation (neither part *looks* like

[59] M.Reuter, *Abschied von Sterben und Tod? Ansprüche und Grenzen der Hirntodtheorie*, Stuttgart, W. Kohlhammer, 2001, p. 54-55.

a human being "as a whole") combined with the profuse and rapid exsan- guination from both parts. True death no doubt occurs some seconds to min- utes later after a critical degree of exsanguination and anoxia in whichever of the two severed parts (or both) is the person. One hardly needs guillotines to know that the heart has its own intrinsic pacemaker and can beat perfectly well without any influence from the brain (although unmodulated in rate)."[60] Hearts removed for transplantation will continue beating spontaneously for some time completely outside the body. Be that as it may, no one can seriously claim that the acutely exsanguinating, unventilated body shown in Pallis and Harley's execution-photo is physiologically equivalent to a brain-destroyed body with normal blood volume, no bleeding, and normal blood gases main- tained by mechanical ventilation.

Since neither grotesque mutilation nor exsanguination characterizes clin- ical 'brain death', there must be something else about decapitation that pro- vides the supposed physiological equivalence with 'brain death'. Moreover, that "something else" must also be a reason why decapitation is death; oth- erwise the purported physiological equivalence would prove that 'brain death' is *not*, rather than *is*, death.

A more plausible case for physiological equivalence can be made only if the decapitation analogy is "President's-Commission style," featuring the hy- pothetical details of immediate suturing of severed neck vessels and cauteri- zation of tissues to prevent bleeding, plus mechanical ventilation through an endotracheal tube placed in the tracheal stump. The major premise in the de- capitation-analogy syllogism is that such a headless body is dead. But this can- not simply be assumed without question. One possible reason for saying that it is dead is to draw attention to the mind/brain-body disconnection: to look over at the severed head and argue that the person is with the head, because the head contains the brain; therefore, what is left of the person's true "body" following decapitation is actually the head, while the rest (whatever it may be) is no longer the person's body. But note that this is not an argument that the headless body is biologically dead (not an "organism as a whole"), but rather that it is not the original person's body. The question presently at hand is whether the maintained headless body is a mutilated "organism as a whole" or is a non-organism with the metaphysical status of a severed limb. If it is

[60] O.D. García, C. Machado, J.M. Román et al., *Heart rate variability in coma and brain death*, in *Brain Death. Proceedings of the Second International Conference on Brain Death. Havana, Cuba, February 27-March 1, 1996*, edited by C. Machado, p. 191-197.

deemed to be an organism, the question whose body it is, if anyone's, is a completely separate issue that will be taken up below in section III.C.
The question presently at hand is therefore: Is the ventilated, non-bleed- ing, headless body a mutilated and terminally ill "organism as a whole" or a mere unintegrated collection of living organs and tissues? To answer that question, we must look directly at the biological properties of such a body. This is rendered difficult by the fact that, thankfully, no such preparation of a human body has ever been or (hopefully) will ever be carried out. Two ap- proaches come to mind to investigate the physiological properties of such a hypothetically maintained headless human body: (1) its physiological equiv- alence with a brain-dead body, and (2) determining the "essential" anatomi- cal component of such decapitation (*vis à vis* 'brain death' theory) and ex- amining the physiological properties of cases of "critical" ("essential") par- tial decapitation.

III. B. 2. *Somatic Physiology in 'Brain Death'*

The first approach sounds strangely circular: to understand whether a brain-dead body is an "organism as a whole," we investigate a decapitated, ventilated, non-bleeding body, which is physiologically equivalent. But there are none to investigate, so to understand whether such a hypothetically main- tained body is an "organism as a whole," we investigate brain-dead bodies, which are physiologically equivalent. There are plenty of the latter to inves- tigate, and the amount of physiological data accumulated over the years is vast. The interpretation of such data has led to conflicting conclusions re- garding whether such a body is a very sick organism or a non-organism (and consequently for our purposes, whether the hypothetically maintained head- less body is a very sick organism or a non-organism).

III. B. 2.a. *Acute Instabilities*

Those who conclude from the somatic physiology of 'brain death' that such a body is a mere collection of organs and tissues, not an "organism as a whole," point to several aspects: multi-system dysfunction and corresponding difficulty maintaining such bodies for any extended period of time in ICUs (e.g., the maintenance of brain-dead pregnant women for weeks to bring the fetus to vi-

ability is always a technological *tour de force*), extreme cardiovascular instabil- ity, and the alleged imminence of cardiovascular collapse despite all techno- logical means to prevent it. Such reasoning is faulty. If brain-dead bodies are in fact unintegrated collections of organs, then such physiological properties would surely follow. But the fact that such physiological properties occur with brain-dead bodies does not prove that therefore they are unintegrated collec- tions of organs. "If A, then B" is not equivalent to "B, therefore A."

Indeed, there are other explanations for the multiple physiological insta- bilities of acute 'brain death' that have nothing to do with the putative expla- nation of the brain being the central integrating organ of the body, without which the body literally dis-integrates. In many cases of 'brain death' the etiol- ogy that damaged the brain also directly damages other vital organs (e.g., se- vere hypoxia-ischemia, massive trauma). In my meta-analysis of 56 cases of 'brain death' with survival at least 1 week, one of the two factors that statisti- cally significantly influenced survival potential was indeed etiology (multi-sys- tem damage had shorter survival potential on average than primary brain pathology).[61] Even in cases of primary brain pathology, the very process of brain herniation, prior to actual death of the brain, can produce a "sympathetic storm" resulting in subendocardial microinfarcts and neurogenic pulmonary edema.[62]

Thus, there could be several reasons why these patients are often so un- stable in the acute phase that have nothing to do with loss of integrating brain function. Moreover, there are many kinds of severe brain lesions short of 'brain death', as well as non-brain lesions (e.g., high spinal cord injury, severe Guillain-Barré syndrome, septic shock, etc.) that result in similar degrees of cardiovascular instability and multisystem dysfunction, but no one concludes from the requirement of a similar level of high-tech ICU care that such pa- tients are already dead. No more does such acute somatic instability *per se* prove that brain-dead patients are already dead.

Another reason for the systemic instability in many cases of acute 'brain death' is spinal shock. As far as the spinal cord is concerned, brainstem in- farction down to the level of the foramen magnum has the same effect as tran- section of the spinal cord at the level of the foramen magnum.[63] Spinal shock

[61] D.A. Shewmon, *Chronic "brain death": meta-analysis and conceptual consequences*.

[62] E.F.M. Wijdicks, J.L.D. Atkinson, *Pathophysiologic responses to brain death*, in *Brain Death*, edited by E.F.M. Wijdicks, p. 29-43 (p. 32-38).

[63] E.O. Jørgensen, *Spinal man after brain death. The unilateral extension-pronation reflex of the upper limb as an indication of brain death*, in "Acta Neurochirgica" (Wien), 28, 1973, p. 259-273;

lasts days to weeks and involves not only hypotonia and loss of tendon reflex- es but also, and more importantly, autonomic areflexia, which exacerbates the instabilities already due to intrinsic or secondary multisystem damage.

III. B. 2.b. *Some 'Brain Dead' Patients are Dead, but not because* only *their Brains are Dead*

I am quite sure that some brain-dead patients are in fact already dead by virtue of associated supracritical multisystem damage, and the mechanical ventilation merely masks this fact. (This "masking" theory of 'brain death' – that there is only one kind of death, and the only difference between tradi- tional "cardio-pulmonary" criteria and the new neurological criteria is that in the latter the death-state is "masked" by the artificial ventilation – is one of the earliest proposed rationales in the history of 'brain death'. It was orig- inally popularized by lawyer-ethicist Alexander Capron[64] and promoted by the President's Commission (of which Mr. Capron was Executive Director)[65] as applicable to *all* cases of 'brain death'. This theory of 'brain death' was obliquely alluded to by Pope John Paul II in his discourse to the Transplan- tation Society, when he described "the traditional cardio-respiratory signs" and "the so-called 'neurological' criterion" as alternative signs for the same physiological state.[66] I suspect that such "masking" of death by the ventilator

E.O. Jørgensen, *Spinal man after brain death. The unilateral extension-pronation reflex of the upper limb as an ultimate indicator of brain death*, in *Brain Death. Proceedings of the Second International Conference on Brain Death. Havana, Cuba, February 27-March 1, 1996*, edited by C. Machado, p. 87-93; D.A. Shewmon, *Spinal shock and 'brain death': somatic pathophysiological equivalence and im- plications for the integrative-unity rationale*, in "Spinal Cord," 37, 1999, p. 313-324; D.A. Shewmon, *The "critical organ" for the organism as a whole: lessons from the lowly spinal cord*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 23-41.

[64] A.M. Capron, *Anencephalic donors: separate the dead from the dying*, in "Hastings Center Report," 17, 1, 1987, p. 5-9; A.M. Capron, *The bifurcated legal standard for determining death: does it work?*, in *The Definition of Death: Contemporary Controversies*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, p. 117-126 (p. 125); A.M. Capron, L.R. Kass, *A statutory definition of the standards for determining human death: an appraisal and a proposal*, in "University of Pennsylvania Law Review," 121, 1972, p. 85-118.

[65] President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: Medical, Legal, and Ethical Issues in the Determination of Death*, p. 33, 35, 58.

[66] John Paul II, *Address of 29 August 2000 to the 18th International Congress of the Trans plantation Society*.

is in fact the case with many brain-dead patients who experience rapid cardiovascular decompensation and cardiac arrest, from which they cannot be resuscitated by any means. If such patients (or some subset of them) are dead, it is not because their brains are dead, but because they suffered supracriti- cal multiorgan damage, including the brain. The diagnostic problem with such cases is that one can't know that they fall into this category until they ac- tually undergo the cardiovascular collapse from which they can't be resusci- tated, and even then one can't be sure whether a given case falls into the "al- ready dead" subset or the "dying" subset.

III. B. 2.c. *Chronic Stability*

Contrary to an endlessly repeated dictum in the earlier 'brain death' lit- erature, and parroted even as recently as 1996 by Pallis and Harley,[67] *not all* brain-dead patients undergo imminent, irreversible cardiovascular collapse. The proportion that could in principle survive longer than a few days with ICU care will never be known, since the huge majority either become organ donors or have the extraordinary-disproportionate life support ethically dis- continued. What is known is that with therapeutic motivation (e.g., brain- dead pregnant women to bring the fetus to viability; cultural reasons - espe- cially in Japan, for example, where many of the long-surviving cases have been reported; respect for family sensitivities and beliefs; etc.), some brain- dead patients have been maintained long enough for many of the acute in- stabilities to resolve: blood pressure stabilizes and pharmacological cardio- vascular support is no longer needed; intestinal ileus resolves and nourishment can be maintained through enteral tube feedings; diabetes insipidus, if initially present, may spontaneously resolve.

As of 1998 I collected some 175 cases of 'brain death' with survivals at least 1 week, not just 56 as is often stated about my article[68] by those who must not have examined the accompanying Tables 1 and 2, which detail all the cases and references.[69] (These tables were too bulky for inclusion in the published article but were available to anyone interested.) The 56 cases were

[67] C. Pallis, D.H. Harley, *Preface to the second edition*, in C. Pallis, D.H. Harley, *ABC of Brain- stem Death*.
[68] E.F.M. Wijdicks, J.L.D. Atkinson, *Pathophysiologic responses to brain death*, in *Brain Death*, edited by E.F.M. Wijdicks, p. 39.
[69] D.A. Shewmon, *Chronic "brain death": meta-analysis and conceptual consequences.*

a subset of the 175 with sufficient individual information available to include in a meta-analysis, which identified two factors that statistically predisposed to longer survival potential: primary brain pathology (as opposed to multi- system damage) and young age. The other 119 cases were from published se- ries with aggregate, rather than individual data; many were from Japan.

This provocative research has been both praised and criticized. Most of the critics have expressed doubt regarding the reliability of 'brain death' di- agnosis in all the cases, whether an apnea test was performed properly, etc.[70] All I can say is to repeat what I wrote in the article itself and quoted in my re- ply to letters to the editor: "If patients were 'brain dead' enough to qualify as organ donors, they were surely 'brain dead' enough to qualify for this study."[71] Even if, for the sake of argument, some of the 175 cases were mis- diagnosed, surely the majority were not; and even more surely still, the longest surviving cases were not.

I will not repeat here the case history of the record survivor, "TK," who at the time of my meta-analysis had been brain-dead for 14½ years and on a ventilator at home. I presented a video of my complete neurological exami- nation of TK at the Task Force on 'Brain Death' of the Pontifical Academy for Life, as well as at the Third International Symposium on Coma and Death in Havana.[72] Everyone who saw the video agreed that the patient met all the clinical criteria for 'brain death' short of a formal apnea test, which could not be ethically performed because there would have been no benefit to outweigh the risks. (He had never been observed to breathe spontaneously for up to 1 minute off the ventilator during suctioning or tracheostomy changes.) Con- firmation of total brain destruction (including the entire brain stem) was ob- tained, however, by an MRI scan, which showed no identifiable brain or brain-stem structure, making the apnea test a moot point. TK finally expired

[70] J.L. Bernat, *Philosophical and ethical aspects of brain death*, in *Brain Death*, edited by E.F.M. Wijdicks, p. 180; J.L. Bernat, *Ethical Issues in Neurology*, p. 257; J.L. Bernat, *On irreversibility as a prerequisite for brain death determination*, in *Brain Death and Disorders of Consciousness*, edit ed by C. Machado and D.A. Shewmon, p. 161-167; E.F.M. Wijdicks, J.L. Bernat, *Chronic "brain death": meta-analysis and conceptual consequences (letter)*, in "Neurology," 53, 1999, p. 1369- 1370.

[71] D.A. Shewmon, *Chronic "brain death": meta-analysis and conceptual consequences*; D.A. Shewmon, *Chronic "brain death": meta-analysis and conceptual consequences (response to letters)*, in "Neurology," 53, 1999, p. 1371-1372.

[72] D.A. Shewmon, *Seeing is believing: videos of life 13 years after "brain death," and con sciousness despite congenital absence of cortex*, presented at the *3rd International Symposium on Co ma and Death*, Havana, Cuba, February 22-25, 2000.

after 20½ years in the brain-dead state. A brain-only autopsy was performed, with singularly remarkable findings that confirmed still more definitively the totality of brain and brain-stem destruction.[73]
I am glad that the autopsy and publication were done by physicians with no relationship to me and with no previous special interest in 'brain death'. It is clear from their multiple choices of words what all four co-authors consider TK's life/death status to have been.

[He] died at age 24 years of complications of *H influenzae* type b meningitis ac- quired at age 4H .[74]
During the rest of his life, he was ventilator dependent… He required chronic care for most of his life... In his final 2 months of life... [H]e experienced a cardiac arrest in January 2004. Following his death, a brain-only autopsy was performed.[75]
Our pathologic findings at autopsy confirmed that his brain had been destroyed by the events associated with the episode of *H influenzae* type b meningitis, where- as his body remained alive (brain death with living body) for an additional two decades, a duration of survival following 'brain death' that far exceeds that of any other reports.[76]

I have no doubt that anyone else who might have seen TK prior to his car- diac arrest would have used similar terms to describe his body: a clearly living human organism, deeply comatose, with vigorous spinal reflexes (both neuromuscular and autonomic); in no way a disintegrated collection of organs and tissues, or a "corpse" whose death was masked for 20 years by a mechanical ventilator.
It takes only a single property at the level of the "organism as a whole" to prove that there is a "whole." But the bodies of TK and other long-term sur- vivors in 'brain death' demonstrate many holistic properties, such as, for ex- ample: complex homeostasis of hundreds if not thousands of interacting chemicals and enzymes, assimilation of nutrients and elimination of wastes, proportional growth, maintenance of body temperature (albeit subnormal and with the help of blankets), wound healing, overcoming of infections, ability to recover from illnesses serious enough to require hospitalization and be

[73] S. Repertinger, W. P. Fitzgibbons, M.F. Omojola, et al., *Long survival following bacterial meningitis-associated brain destruction*, in "Journal of Child Neurology," 21, 2006, p. 591-595.
[74] Ibid., p. 591.
[75] Ibid., p. 592.
[76] Ibid., p. 594.

discharged home again, systemic stress responses to noxious stimuli, feed- back balance of various endocrine functions, etc.[77] A 13-year-old boy in my series, whom I personally examined in a skilled nursing facility, began pu- berty while brain-dead.[78]

These chronic cases, though rare, teach several important lessons about the nature of 'brain death'. (1) The systemic instabilities associated with acute 'brain death' are due to a combination of factors other than mere lack of brain control over the body: primary multisystem damage (depending on etiology), secondary cardiac and pulmonary damage from the process of brain hernia- tion, and spinal shock. Therefore, these often transient instabilities cannot be cited as evidence that the body's integrative unity depends on brain function per se. (2) Whereas some brain-dead patients may in fact be dead by virtue of supracritical multisystem damage, some are clearly living organisms, albeit severely disabled and dependent on a mechanical ventilator, tube feeding and nursing care. (Again, the question of whose body such an organism is, if any- one's, is a separate issue, primarily philosophical rather than biological in na- ture, which will be taken up in section III.C. below.) (3) "Chronic 'brain death'" would no doubt be more common if not for the fact that in the huge majority of 'brain death' cases, either organs are harvested or the extraordi- nary/disproportionate care is terminated within hours of the diagnosis.

III. B. 2.d. *The Body has no "Primary Integrating Organ"*

Why do so many people think that if there is somatic integration, there has to be a single, primary organ responsible for it? Plants and embryos have no central integrating organ; rather, the integration is clearly a non-localized emergent phenomenon involving the mutual interaction among all the parts. Two kinds of distinction have to be made: on the one hand the distinction between a healthy, optimally functioning organism and a sick and/or disabled organism; and on the other hand the distinction between a very sick, marginally functioning organism and a dead one (a non-organism). For hu- man organisms the brain is clearly the primary organ as regards the first dis-

[77] D.A. Shewmon, *The brain and somatic integration: insights into the standard biological rationale for equating "brain death" with death*, p. 457-478.

[78] D.A. Shewmon, *Chronic "brain death": meta-analysis and conceptual consequences*, Table 1, "BES."

tinction: it is the organ that gives humans superiority over all other earthly creatures, the organ most intimately involved in the human mind, personali- ty, and spirit. The human brain is regarded by many as the most awesome structure in the entire physical universe, and it is the reason why most neu- rologists, like myself, chose neurology as a career.

But the distinction "healthy vs. sick" (or "optimally functioning vs. dis- abled") has little if anything, physiologically or philosophically, to do with the distinction "marginally alive vs. dead." Therefore, the primacy of the brain regarding human health and mental life in no way implies that the brain is al- so, and necessarily, the primary organ for life vs. death of the human organ- ism, or even that there is a "primary organ" for life vs. death.

III. B. 3. *The Essential Component of "Physiological Decapitation"*

We have already determined that exsanguination is not a component of "physiological decapitation." What aspect of decapitation, then, is the es- sential one that supposedly makes it death? A related but distinct question, to be taken up later, is: What aspect of decapitation is the essential one that supposedly makes it physiologically equivalent to 'brain death'? We shall see that the answers are not the same, which is a major problem for the analogy. Insight into the first question (What essential component of decapitation makes it death?) may be gained by considering two extremes of partial de- capitation. If the guillotine blade got stuck after penetrating only 1 mm into the epidermis of the back of the neck, it is obvious that the intended victim is still alive. On the other hand, if the blade passed through almost the entire neck and got stuck 1 mm from the surface of the front of the neck, leaving the head attached to the rest of the body only by a small sliver of skin, it is obvious that for the heuristic purposes of the analogy, this would be just as much death as a 100% complete decapitation (if, in fact, it is per se death). Now we have a conceptual dilemma, because life and death are generally understood as mutually exclusive categories, whereas the degrees of partial decapitation are along a continuum from infinitesimal to 100% minus infinitesimal, and the possible anatomical patterns of each degree are infinite. Where along such continua does life pass to death (assuming the analogy's utility as an explanation of 'brain death'), and what non-arbitrary explanation can be given for the answer?

III. B. 3.a. *Candidate Components*

One consideration that may help is that the cross-sectional anatomy of the neck is not homogeneous, so the relevant question may not be in terms of dis- tance traversed by the blade, but rather what anatomical structures are or are not severed. It would be more meaningful and heuristically fruitful to forget about instantaneous decapitation from a large guillotine blade and imagine in- stead a slow-motion decapitation from precise serial cuts from a surgical scalpel. The question can then be rephrased, whether there is a critical structure or set of structures, severance of which is the "essence," so to speak, of decapitation, insofar as that alone suffices to produce the death of decapitation, whereas sev- erance of any or all "non-critical" structures does not produce death. Let us con- sider the following most likely candidates for "critical" structures: (1) the non- neural, non-vascular tissues of the neck (skin, fat, fascia, muscles, cartilage, ligaments, bone); (2) the major blood vessels passing through the neck; (3) the neural elements (spinal cord, phrenic and vagus nerves); (4) all of the above (i.e., the total separation of head from body). We now consider these one by one.

(1) Non-neural, non-vascular tissues are clearly not critical: selective severance of these, with preservation of blood vessels, spinal cord, phrenic and vagus nerves, would produce a severe mechanical instability, in essence a severe cervical vertebral fracture with extreme soft tissue injury. Such a patient would be perfectly conscious, able to breathe and move all extremities normally. If the patient were brought to an emergency room in such a condition, a neurosurgeon would place him or her in a metal "halo" device to immobilize and stabilize the head to allow the cervical fracture to heal over ensuing weeks (the juxtaposed severed soft tissues would also gradually reconnect by scar formation, no doubt with the help of surgical sutures). Clearly such a patient is not dead by virtue of the structures severed, and this form of partial decapitation is not death.

(2) Severing of the major blood vessels in the neck is not death, but certainly will very quickly produce death from exsanguination, beginning with loss of consciousness within a few seconds from the sudden, total lack of blood flow to the brain, followed by progressive damage, at first reversible and soon irreversible, to all the organs and tissues of the body due to hypovolemic shock and complete exsanguination. The organs succumb not all at once but in a well known sequence, depending on their selective vulnerability to ischemia, beginning with the brain, then kidneys, liver and heart, then soft tissues, and much later skin and bone. When along this sequence of ischemic damage

death actually occurs is not entirely clear, but it is certainly at least some min- utes after the severing of the vessels. As pointed out above, such death from exsanguination has no resemblance to 'brain death', and in fact the most "physiological" version of the "physiological decapitation" analogy has the vessels sutured closed as soon as they are severed, to prevent blood loss. A ves- sel-focused physiological analogy with 'brain death' would be the simultane- ous ligation (rather than severing) of all the major blood vessels to the brain, resulting in total brain infarction. But such ligation is not a physiological anal- ogy of 'brain death'; it would actually be a particular cause of 'brain death' some minutes later. Blood vessels are not the essential core of the "physiolog- ical decapitation" analogy.

> (3) Selective sectioning of the neural elements produces apnea and quadriplegia. Such a patient brought to an emergency room would be placed on a mechanical ventilator and admitted to an ICU for stabilization of blood pressure, and management of a variety of systemic complications of acute spinal cord injury. After some days or weeks, the patient would be transferred to a rehabilitation unit. Clearly this form of partial decapitation is not death.
>
> (4) Complete physical separation into two parts (abstracted from the exsanguination issue) seems the only possibility left. In other words, there is no essential core of partial decapitation that is per se death. If both head and headless body are technologically kept alive through attaching the body to a ventilator and keeping the head perfused with oxygenated blood by attaching its major vessels to a cardiopulmonary bypass machine, then we can legitimately question whether even complete physical separation is per se death or rather a condition that would quickly lead to death if heroic medical intervention had not taken place. Whether the original person is with the head-part, the body-part, both, or neither, is again a philosophical issue to be taken up later; here we are focusing on the biology of the body-part.

Surprisingly, when we search for the essential anatomical core of decapi- tation that makes it death, we find that, not only is it elusive, but not even complete decapitation may per se be death after all (as opposed to an injury that would ordinarily quickly lead to death).

III. B. 3.b. *Brain-Body Disconnection in High Cervical Cord Transection*

That having been determined, we now address the second question posed above: What form of partial decapitation captures the essence of the physio-

logical analogy with 'brain death' (setting aside whether either is death or not)? The answer is clearly the sectioning of the nervous elements: spinal cord, vagus and phrenic nerves. If the sectioning is above the exit level of the phrenic nerves, then we need concern ourselves only with high spinal cord and vagus nerve. Theoretically, the somatic physiology of 'brain death' and that of high spinal cord transection plus vagotomy ought to be identical, apart from the influences of pituitary function, which are variable in 'brain death' but intact in spinal cord transection. This comparison was astutely drawn by Youngner and Bartlett back in 1983,[79] and it still remains perfectly valid. To make the somatic analogy conservatively complete, we could compare 'brain death' with the combination of high spinal cord transection plus vagotomy plus hypothalamic hypopituitarism. The comparison is necessarily valid in principle, because in both cases the body "sees" only the parts of the nervous system distal to the foramen magnum: in the one case because the rostral parts are missing, and in the other case because they are disconnected.

The theory is also borne out by clinical data. A detailed point-by-point comparison of the pathophysiology of 'brain death' and the pathophysiology of high spinal cord transection reveals that the two conditions are indeed clin- ically identical (particularly if the spinal cord lesion is combined with vagoto- my and hypopituitarism, or if the 'brain death' does not involve much pitu- itary dysfunction). The *only* difference is consciousness (by no means a minor difference, but we are focusing here strictly on the issue of somatic physiolo- gy). In fact, a typical textbook chapter on the ICU management of brain-dead organ donors and a typical textbook chapter on the ICU management of high spinal cord injury patients are so nearly identical that one could be trans- formed into the other simply by switching the terms "'brain death'" and "spinal cord injury." This is the case not only in the acute phase, when spinal shock plays a major role in the instabilities of each condition, but also in the subacute and chronic phases, when spinal reflexes and spinally mediated in- tegration return. For a detailed itemization and discussion of these parallels, see other works of the author.[80] The essential core of the "physiological decapitation" analogy with 'brain death' is high cervical cord transection plus vagotomy. But patients with high spinal transection are clearly not dead - and *not only* because they are con-

[79] S.J. Youngner, E.T. Bartlett, *Human death and high technology: the failure of the whole-brain formulations*, p. 254.

[80] D.A. Shewmon, *Spinal shock and 'brain death': somatic pathophysiological equivalence and implications for the integrative-unity rationale*; D.A. Shewmon, *The "critical organ" for the organ- ism as a whole: lessons from the lowly spinal cord*, in *Brain Death and Disorders of Consciousness*.

scious. It is not that they are conscious mind/brains within a jumble of unin- tegrated organs and tissues; rather, they are clearly still living mental/corpo- real beings, with biologically living bodies, although ventilator-dependent and severely disabled due to the brain's lack of influence over the rest of the body.

Two conclusions follow. (1) If high-cord-transected bodies are disabled "organisms as a whole," then brain-dead bodies are equally disabled "or- ganisms as a whole," the former being conscious organisms and the latter be- ing unconscious organisms. (2) Loss of somatic integrative unity is not a vi- able rationale for either 'brain death' or the decapitation analogy. If 'brain death' is death, it can only be so by virtue of permanent loss of consciousness, as maintained all along by the "higher 'brain death'" advocates. This would imply that not only "'brain death'" but any neurological lesion producing permanent unconsciousness (e.g., permanent vegetative state) is also death.

III. B. 4. *Logical Disconnects between 'Brain Death' Theory and Practice*

Brain-body disconnection, which is the essence of the "physiological de- capitation" analogy, brings to light a number of paradoxes or logical discon- nections between mainstream 'brain death' theory and mainstream 'brain death' practice.

1. What is so magical about the cervicomedullary junction that brain-stem mediated somatic integration "counts" for life/death status, but spinal-cord-mediated somatic integration does not "count"?
2. In the context of all other criteria for 'brain death' having been met, why should the presence of a somatically irrelevant sluggish pupillary reflex mean the patient is alive, whereas the presence of a somatically integrative hypothalamic function (e.g., maintenance of water balance through regulated secretion of antidiuretic hormone) does *not* mean the patient is alive?
3. Some patients with all the clinical signs of 'brain death' (on the basis of primary "brain*stem* death") can have prominent electroencephalographic activity, including even patterns resembling physiological sleep.[81] Therefore,

[81] A. Esteban, A. Traba, J. Prieto et al., *Prolonged EEG activity in brainstem death*, in *Brain Death. Proceedings of the Second International Conference on Brain Death. Havana, Cuba, Febru- ary 27-March 1, 1996*, edited by C. Machado, p. 151-156; M.M. Grigg, M.A. Kelly, G.G. Celesia, et al., *Electroencephalographic activity after brain death*, in "Archives of Neurology," 44, 9, 1987, p. 948-954.

when the American Academy of Neurology practice parameter states that 'brain death' is a clinical diagnosis and that electroencephalographic confir- mation is not necessary, it implies that it doesn't matter whether the cerebral cortex is functional or not so long as the brainstem is nonfunctional, thereby tacitly aligning itself with the British "brainstem death" notion and discon- necting its 'brain death' diagnostic criteria from all U.S. statutory laws defin- ing the neurological diagnosis of death in terms of the totality of brain non- function.

4. If the mainstream rationale for equating 'brain death' with death is still integrative unity ("organism as a whole"), why do the mainstream diagnostic criteria for 'brain death' not require a single somatically integrative function to be checked and why do they explicitly allow some integrative functions to be present without invalidating the diagnosis (e.g., secretion of antidiuretic hormone, cardiovascular stability, autonomic and endocrine stress responses to unanesthetized surgical incision)? Why should such somatically integrative functions be more diagnostically "spurious" than a somatically non-integrative function such as a corneal reflex?[82] To dismiss such integrative functions as "spurious" amounts to dismissing the mainstream rationale of integrative unity itself as "spurious."

5. Another logical inconsistency has to do with the cardiovascular insta bility in acute 'brain death', which is often cited as supportive evidence that 'brain death' is death – so much so that one unusually coherent 'brain death' defender went so far as to state that, if there is cardiovascular stability with out pharmacologic support, then the patient cannot be truly brain dead even if all the other signs are present, and that in such a scenario the heart cannot be ethically harvested.[83] On the other hand, the American Academy of Neu rology diagnostic guidelines[84] explicitly regard cardiovascular stability with out pharmacologic support as compatible with the diagnosis of 'brain death', and cardiac surgeons regard the best hearts for transplant as coming specifi-

[82] B.A. Brody, *How much of the brain must be dead?*, in *The Definition of Death: Contempo rary Controversies*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, p. 71-82 (p. 73); A. Halevy, B.A. Brody, *Brain death: reconciling definitions, criteria, and tests*, in "Annals of Internal Medi cine," 119, 1993, p. 519-525; R.D. Truog, J.C. Fackler, *Rethinking Brain Death*, in "Critical Care Medicine," 20, 12, 1992, p. 1705-1713.

[83] J. Cervós, *¿Cuándo muere el individuo? Definición de la muerte cerebral*, in "Atlantida," 2 1991, p. 9-13.

[84] American Academy of Neurology - Quality Standards Subcommittee, *Practice parameters for determining brain death in adults (Summary statement)*.

cally from brain-dead donors with cardiovascular stability without pharma- cologic support.[85] Thus, the very physiological qualities of the best heart donors logically conflict with the theoretical reason why they are supposed- ly dead in the first place in order to donate ethically.

6. Yet another mental disconnect is the fact that, although mainstream neurology still semi-officially endorses the integrative-unity rationale, many experts in their heart of hearts endorse the consciousness-based rationale (dead person despite a live body). (See above quotations from Drs. Plum and Cranford; also personal impression from many conversations with colleagues on this issue.)

7. Finally, there is the logical disconnection surrounding the "physiological decapitation" analogy itself. The thought-experiment analogy is supposed to help us understand why 'brain death' is cessation of the organism as a whole. But in the final analysis, we need to examine the actual pathophysiology of 'brain death' in order to determine what the pathophysiology of a headless, ventilated, non-bleeding body would be like – and when we do, we are forced to conclude, after overcoming the instinct of revulsion at the mutilated appearance, that the decapitated body is after all an organism as a whole, to the same extent that a high spinal cord-transected body is, to the same extent that a brain-dead body is. Whose body the headless living organism is, if anyone's, is a totally different question, to which we shall turn now.

III. C. *Focus on the Head - Who's there, if Anyone?*

In our thought experiment, let us arrange things so that not only the ven- tilated body does not exsanguinate, but also the severed head, which is kept alive by attaching the major vessels to a cardiopulmonary bypass machine. Since nothing has been done to interfere with the brain's mediation of con- sciousness, we can reasonably assume that the head is conscious, with the same personal consciousness as before the operation, and that it can com- municate with us through facial and eye movements. In my first 'brain death' publication, I argued that, since bone and soft tissue do not contribute to

[85] J.M. Darby, K. Stein, A. Grenvik, et al., *Approach to management of the heartbeating 'brain dead' organ donor*, in "Journal od the American Medical Association," 261, 1989, p. 2222-2228;
W.G. Guerriero, *Organ transplantation*, in *Neurotrauma*, edited by R.K. Narayan, J.E.J. Wilberg- er, J.T. Povlishock, New York, McGraw-Hill, 1996, p. 835-840.

consciousness, the thought experiment would be just the same, and produce a greater external resemblance to 'brain death', if only the brain were re- moved and kept alive floating in a vat, by means of attaching the major blood vessels to a cardiopulmonary bypass machine.[86] Based on what we know about brain and consciousness, this would result in the same personal con- sciousness associated with the isolated brain as with the full head, except now the conscious mind is cut off from all communication with the rest of the world and remains alone in its thoughts and memories. The brainless body is physiologically identical to a brain-dead body.

1. *The Challenge of the Thought Experiment*

Given that the headless (or brainless) body is a living organism, as estab- lished in the foregoing section, and that the head (or isolated brain) is the pu- tative locus of the original conscious person, what conclusions can be drawn regarding the personal status and/or identity of the body? At first glance it would seem that the person's true "body" is the brain plus whatever is phys- iologically integrated with the brain (the head, or the entire intact body pre- decapitation); conversely, whatever is physiologically and spatially discon- nected from the brain is not that person's body, regardless whether it is a liv- ing organism or not. Therefore, if now the isolated brain were disconnected from its life-support and allowed to die, the still living brainless body would remain just the same: a living organism but not the body of the original per- son. This is exactly what obtains in 'brain death', except that the total brain infarction takes place *in situ* rather than following surgical removal and tem- porary maintenance in a vat. Thus, the analogy lends strong support to the consciousness-based rationale for 'brain death', namely that the brain-dead body is a living organism but no longer a living human person: the original person died when the brain died. This line of argumentation was very con- vincing to me in the decade of the 1980s, and it formed the core of my de- fense of 'brain death', initially of "higher 'brain death'"[87] and later of a mod- ified version of "whole 'brain death'."[88]

[86] D.A. Shewmon, *The metaphysics of brain death, persistent vegetative state, and dementia*.
[87] Ibid.
[88] D.A. Shewmon, *Caution in the definition and diagnosis of infant brain death*, in *Medical Ethics: A Guide for Health Professionals*, edited by J.F. Monagle and D.C. Thomasma; D.A. Shew- mon, *'Brain death': a valid theme with invalid variations, blurred by semantic ambiguity*, in *Work-*

At the time I had not yet realized that the headless (or brainless) body was a living "organism as a whole" in its own physiological right, although a se- verely disabled one. Since the isolated living head (or brain) was the original person, I assumed without much further consideration that therefore the rest of the "body" could not possibly be a true body but rather something with the metaphysical status of a severed limb, only larger and more heteroge- neously structured. In 1992 the physiological equivalence between 'brain death' and high spinal cord transection first dawned on me, forcing a diffi- cult re-interpretation of the thought experiment in the new light of the head- less (or brainless) body being rather a permanently comatose, disabled, liv- ing human "organism as a whole." For several years I was not sure how to reconcile these two apparently conflicting theoretical arguments for and against 'brain death' being death of the individual, but I was surer of the em- pirically demonstrable somatic equivalence with spinal cord transection than of philosophical speculations on a hypothetical thought experiment.

After 5 years of laying low on the topic, I ventured forth again in the liter- ature with my new, iconoclastic position against 'brain death' as death. In the autobiographical narrative of my intellectual journey, I realized that the thought experiment had to be seriously dealt with, and I attempted a reinter- pretation of it in keeping with my new attitude toward brain death.[89] That at- tempt received various criticisms, largely from higher 'brain death' advocates, and in retrospect I concede the validity of certain criticisms.[90] I was never fully satisfied with my own reinterpretation even at the time, but was simply un- able to come up with a better reconciliation between what seemed an unas- sailable physiological conclusion of "organism as a whole," on the one hand, and death of the person with death of the brain in the thought experiment, on the other hand. Since then, my writings have focused on the organism as a whole, showing that brain function is not after all necessary for integration of the body, and that somatic integration is not localized to a particular master- organ but is diffuse throughout the body in the mutual interactions among its parts. The thoughts expressed here represent my first dealing with the decap- itation analogy since 1997; hopefully the intervening 9 years have occasioned some additional insights and perspectives on the matter.

ing Group on the Determination of Brain Death and its Relationship to Human Death. 10-14 De- cember, 1989, edited by R.J. White, H. Angstwurm, I. Carrasco de Paula.

[89] D.A. Shewmon, *Recovery from "brain death": A neurologist's Apologia*, p. 70-75.

[90] J.P. Lizza, *Persons, Humanity, and the Definition of Death*, p. 102-107.

2. *Reductionistic Interpretation*

I am now convinced that the interpretation of the thought experiment is highly dependent on one's basic philosophical world-view. For a material monist and person/mind/brain reductionist, the solution is clear. The person is with whatever part contains the functioning brain. In case the analogy is extended to separation of only part of the brain (as proposed in my original *Thomist* paper[91]), then the person is with whatever contains the part of the brain that is conscious. That is now the person's true "body," severely muti- lated and hardly recognizable as a human body, but one nonetheless; the rest is not the person's body, no matter how much it might look like a human body. Given that it is biologically an "organism as a whole," it could be called a "humanoid organism."[92] The person dies when the part with the conscious brain dies, not when respiration and circulation irreversibly stop in the head- less (or brainless) body. Since this is exactly what obtains in 'brain death', except that the brain dies *in situ* rather than after separation from the body, it follows logically that clinical 'brain death' is just as much personal death as is death of the separated conscious brain in the thought experiment.

3. *Aristotelian-Thomistic Interpretation*

A different analysis obtains, however, in the framework of the basic philo- sophical world-view of Aristotle, developed and "baptized" by Thomas Aquinas, officially endorsed by the Catholic Church, and accepted implicit- ly or explicitly, in greater or lesser detail, by many non-Catholics who reject both material monism and Cartesian dualism. In this context, the interpreta- tion of the analogy becomes much more complicated, because the human soul must also, and primarily, be taken into account. In the Aristotelian- Thomistic tradition, the human soul is not simply a spirit but the "substan- tial form" or life-principle of the body. In distinction from plant and animal "souls," the human soul has a spiritual dimension which is the ultimate basis for hybrid spiritual/physical mental acts (which necessarily involve brain ac-

[91] D.A. Shewmon, *The metaphysics of brain death, persistent vegetative state, and dementia*. [92] J.P. Lizza, *The conceptual basis for brain death revisited: loss of organic integration or loss of consciousness?*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, p. 52; J.P. Lizza, *Persons, Humanity, and the Definition of Death*, p. 15; D.A. Shewmon, *The metaphysics of brain death, persistent vegetative state, and dementia*.

tivity but are intrinsically irreducible to physical brain activity alone), such as reflective self-awareness, abstract concept formation, and volition. The brain is necessary for the interaction between the spiritual ego-center and the rest of the body and the world, but the person and the person's mental activities are more than mere electrochemical brain activity and involve a whole im- material/spiritual dimension of existence, which the reductionist does not recognize. This view of soul/mind/brain/body relationships differs substan- tially from that of Cartesian dualism, in which a purely spiritual soul/mind somehow interacts with an essentially mechanical body. Rather, the soul is at one and the same time the spiritual basis for the immaterial dimension of mental functions *and* the life-principle of the body, making it an "organism as a whole." Separated from the body at death, the human soul is incomplete; it is in some sort of conscious state but cannot perform properly human men- tal functions without the instrumentality of the brain. This emphasizes the importance of the doctrine of resurrection of the body for Catholicism. (Con- trast this with the Platonic notion of the soul as a spirit imprisoned in the body, which is not its fully functioning self until released from the body at death into a purely spiritual realm of existence.)

Within this philosophical framework, then, the human soul: (1) has an im- material dimension that allows it to persist after bodily death; (2) utilizes the brain as an instrument for properly human mental functions, but is itself the basis for those spiritual/immaterial aspects of mental functioning that are in- trinsically irreducible to electrochemical or other physical brain activity; (3) is also by nature the life-principle ("substantial form") of the body; and (4) as such is present throughout all parts of the body, not only in the brain (which would be a variation on Cartesianism, with the brain as a whole tak- ing the place of Decartes' pineal gland). An important corollary is that brain lesions producing unconsciousness, even if permanent, *paralyze* the mental powers of the soul but do not annihilate them, no more than the cutting of all the strings of a piano would make the performer any less of a pianist. This is a key difference between Aristotelian-Thomistic anthropology and per- son/mind/brain reductionism: the former admits of such a notion as a "per- manently unconscious person," whereas the latter does not. For the former, as long as there is evidence that the body is alive (an "organism as a whole"), then the soul and person are present, even if rendered permanently uncon- scious by a brain lesion. For the reductionist, if such a body is alive, it is sim- ply not the original person's body any longer (a nonpersonal "humanoid or- ganism"), and the person is still dead by virtue of the permanent uncon-

sciousness. For the reductionist the notion of a "permanently unconscious person" is a contradiction in terms, whereas for the non-reductionist there is no contradiction at all.

Approaching the thought experiment from this world-view, we can make the following observations. Since mental functions (presumably) continue to be mediated by the isolated brain, the soul must be "informing" the brain (or the head with the brain, depending on which version of the thought experi- ment). This seems clear enough. The difficulty has to do with what to make of the brainless (or headless) body, given its biological status as an "organism as a whole." Several theoretical possibilities present themselves: (1) The brainless (or headless) body has a new "soul" or life-principle, but not a new spiritual human soul - rather, some kind of animal "soul," albeit not that of any naturally occurring animal species. (2) The brainless (or headless) body has a new human, spiritual soul, something analogous to twinning during ear- ly human embryogenesis. (3) The one original soul, because of its immateri- ality, transcends the limitations of space and informs *both* the brain (head) and the brainless (headless) body, even though they are physically separated. (This would seem to invoke a somewhat unorthodox notion of Aristotelian hylomorphism and its Thomistic application to the human soul).

4. Need for a Refinement of Aristotelian-Thomistic Anthropology

Such a thought experiment falls into a class of related philosophical prob- lems involving the splitting and fusing of biological organisms, such as: pla- naria and other lower species that can regenerate a whole organism from a severed part, twinning of human or animal blastocysts, and Siamese twins. When a planarium is bisected and each part grows into a new whole pla- narium, how would Aristotle have answered the question which of the two resulting worms has the original substantial form and which has a new sub- stantial form that was educed from the potency of matter at the moment of bisecting? (Or was the original form lost, and two new forms educed?) Prob- ably he was not aware of this remarkable biological phenomenon, and his sys- tem of hylomorphism was developed based on the ordinary things of nature that he observed. Perhaps hylomorphism is not a fully adequate metaphysi- cal system for explaining what happens when a planarium is bisected. The same dilemma applies to human twinning, only worse, because the human soul's spirituality cannot be simply "educed from the potentiality of matter"

as animal souls are. Thus, with human twinning, it remains mysterious and probably intrinsically unknowable whether there were two souls already pre- sent prior to the twinning - and that's precisely why the twinning happened
- or only one soul prior and two afterwards, in which case it remains obscure which twin kept the original soul and which got a newly created soul. And in the case of Siamese twins that share many vital organs and blood circulation, there seem to be two human souls but only one body, which is hard to rec- oncile with hylomorphism; or else there are two bodies, each "informed" by its respective soul, but with complex domains of overlap that seem to be in- formed by both souls.
Traditional Aristotelian hylomorphism does not seem adequate to ac- count for such phenomena. Whether what is needed is a further development of hylomorphism or a completely new philosophical framework that better accounts for such biological phenomena without conceptually sacrificing the spirituality of the human soul or its essential relationship with the human body - I do not know. I am not a philosopher, and I am not ashamed to ad- mit that I have no definite, logically defensible answer for the thought ex- periment any more than I do for the related questions regarding planaria, twinning, and Siamese twins. In the end, especially regarding the human ex- amples, we may have to be content simply remaining agnostic about one or two souls, which soul, etc., and simply stand in respectful awe of the mystery of human life.

5. *The Thought-Experiment is actually irrelevant to Clinical 'Brain Death'*

This sounds like an intellectually rather weak alternative to the reduction- ists and "higher 'brain death'" advocates. But I would also assert that the in- ability to definitively, non-arbitrarily, solve the thought-experiment dilemma within the context of traditional Aristotelian-Thomistic anthropology is actu- ally not a problem at all for understanding 'brain death' within the same philo- sophical framework - because in real 'brain death' cases, there is no separation into two parts, so the question never arises which part has which soul (or which kind of soul). Throughout the entire pathophysiological process of to- tal brain infarction, there is only one "part" (i.e., the entire body), and as long as it remains a living organism, then we can be sure that the soul is there as its life-principle, even if the soul's mental powers are suspended due to the de- struction of the organ through which those powers are designed to operate.

Thus, when examined in depth, the decapitation analogy and related thought experiments shed no heuristic light at all on 'brain death', but only confuse things by diverting philosophical attention to interesting but tan- gential questions, the answers to which do not determine the ultimate un- derstanding of 'brain death'. The "essential" partial decapitation analogy, on the other hand, does shed considerable light on the subject by highlighting the physiological equivalence between 'brain death' and high spinal cord transection (plus vagotomy, plus-or-minus diabetes insipidus), which is the critical essence of "physiological decapitation."

In summary, for the reductionist, the brain-dead body is a living "hu- manoid organism" but no longer the body of a person, who is dead by virtue of permanent unconsciousness. For those who accept an Aristotelian- Thomistic type of spiritual soul, some brain-dead bodies are indeed dead by virtue of supracritical multisystem damage, whereas others (with pathology relatively limited to the brain) are permanently comatose, severely disabled, still living human beings; in either case, death of the brain *per se* does not con- stitute human death.

IV. '*Brain Death' and the new Cartesianism*

The 'brain death' literature is full of word-choices that juxtapose "brain" and "body" as though the brain were not part of the body but rather an entity unto itself that governs the body, which in turn is regarded as essentially a complex machine in need of external governance and coordination. An illustrative example is the phrase, encountered frequently in the more recent brain-death literature, "brain death with prolonged somatic survival," which clearly implies that the *soma* or body does not include the brain. Moreover, the mechanistic view of the body so permeates modern biology and medicine that one can hardly get a manuscript or a grant application accepted without some reference to "basic mechanisms."

There is much structural similarity between Decartes' mind-body dual- ism and the "brain-body" dualism which is currently in vogue. An important difference is that Descartes' dualism involved a purely spiritual mind and a purely mechanical body, whereas the neo-Cartesian dualism is purely mate- rialistic, with the brain operating on "mechanical" principles just as much as the rest of the body. Another important difference is semantic, regarding the term "body": for Cartesianism the "body" includes the brain, whereas for the

type of neo-Cartesianism under discussion, "body" includes everything ex- cept the brain.

Keeping these differences in mind, the structural similarities are fascinat- ing and illuminating. For both, there are two distinct entities in a hierarchical relationship, with the mental entity governing the mechanics of the non-men- tal entity. For Descartes, the anatomical locus of interaction between mind and body was the pineal gland; for neo-Cartesianism it is the cervicomedullary junc- tion. Decartes could not comprehend that human mental functions are a spir- itual-physical hybrid, neither reducible to nor separable from bodily (brain) functions. Neo-Cartesians cannot comprehend that the human body is a uni- fied hybrid of neural and non-neural elements, and that the neural elements are continuous with each other, so that the brain is a separate entity from the spinal cord only in diagrams, not in reality (cf. the many white matter tracts passing through both, and the transition zone between upper cervical cord and lower medulla). Even if the brain is destroyed, there is still the rest of the nervous sys- tem: the spinal cord with its intrinsic integrative functions and its two-way com- munication with almost all other parts of the body via peripheral and auto- nomic nerves. Just because these parts of the nervous system are not associat- ed directly with mental function, they should not be underestimated in terms of their role in the maintenance of an "organism as a whole."

The intellectual sin of both "isms" is to reify and compartmentalize what are in reality two inextricable components of a single hybrid entity. No doubt the very language we use (with distinct words for these components: "mind," "brain," "body"), plus our tendency to think with our imagination in simple diagrams and compartments, are strong temptations in the reifying direction, but our intellects must overcome such conceptual laziness.

V. *What is Death, if not 'Brain Death'?*

So far, I have expounded on what I think is *not* death. I should not con- clude without stating succinctly what I think death *is*. In keeping with the tra- ditional tripartite distinction introduced by Bernat and colleagues between "definition" (concept), "criterion" (anatomical substrate), and "tests" for death,[93] I would say that my concept of death of a human person is the same

[93] J.L. Bernat, *Philosophical and ethical aspects of brain death*, in *Brain Death*, edited by E.F.M. Wijdicks; J.L. Bernat, C.M. Culver, B. Gert, *On the definition and criterion of death*.

as expressed eloquently by the late Pope John Paul II, namely, "a single event, consisting in the total disintegration of that unitary and integrated whole that is the personal self. It results from the separation of the life-principle (or soul) from the corporal reality of the person."[94] I also agree with the Pope that the exact moment of this event cannot be precisely determined empirically, but that there can be "biological signs that a person has indeed died."[95]

Turning now to the level of criterion or anatomical substrate, there could be many possible valid criteria ("biological signs") that a person has already died. But the closer one tries to get to the unobservable moment of death it- self, the more difficult it becomes to formulate a universally valid and certain criterion. Rigor mortis is a valid criterion far from the moment of death and therefore not a clinically very useful one. A probably valid criterion close to the moment of death might be something like: "cessation of circulation of blood for a sufficient time (depending on body temperature) to produce ir- reversible damage to a critical number of organs and tissues throughout the body, so that an irrevocable process of disintegration has begun." At nor- mothermia, the minimum sufficient time is probably somewhere around 20 minutes, although there are insufficient data to support a precise duration with certainty.[96] I do not believe that the critical number of organs and tis- sues can be universally specified, as it will no doubt vary from case to case; surely the brain is included, but not *only* the brain.

This is similar to the traditional "cardio-pulmonary" criterion, but it is a refinement of it, because neither heart nor lung function is necessary for life (people with artificial hearts, on cardiopulmonary bypass, extracorporeal membrane oxygenation, etc. are most certainly alive). The above proposed criterion is better called "circulatory-respiratory," emphasizing what is real- ly critical for maintaining the integration of the organism as a whole. "Respi- ratory" is to be understood in this context not as "breathing" but in the bio- chemical sense of exchange of oxygen and carbon dioxide in the mitochon- dria of every cell throughout the body (the enzymes involved are often col- lectively called the "respiratory chain"). Perhaps a still better term could be devised that avoids the ambiguity inherent in "respiratory."

[94] John Paul II, *Address of 29 August 2000 to the 18th International Congress of the Trans plantation Society*, § 4.
[95] Id.
[96] J. Lynn, R. Cranford, *The persisting perplexities in the determination of death*, in *The Defi nition of Death: Contemporary Controversies*, edited by S.J. Youngner, R.M. Arnold, R. Schapiro, p. 101-114 (p. 108).

The precise sequence of organ failure can be highly variable from one death to the next, depending on the cause and overall context of death. I al- so think that the moment death can be legitimately "declared" and acted up- on can vary, depending on the type and context of the death.[97]

VI. *Conclusion*

As admitted by 'brain death' defenders and critics alike at the 3rd Inter- national Conference on Coma and Death and in the October 2001 issue of *Journal of Medicine and Philosophy*, the accumulation of clinical evidence and theoretical considerations have indeed undermined some of the sacred mantras of traditional 'brain death' theory and driven "the nails into the cof- fin"[98] of a biological, organism-as-whole rationale for equating death of the brain with death of the individual. Whether official neurology acknowledges it or not, the active debate among experts in 'brain death' theory has shifted from the biological to the philosophical domain, where the key question is: Is a permanently unconscious living human being still a human person? The answer to that depends on one's fundamental philosophical world-view and cannot be further elucidated by scientific investigation. It is in this philo- sophical arena that material reductionists and those who believe in a spiritu- al co-principle of human beings must respectfully part company, the former answering "No" and the latter answering "Yes."

Such affirmation of the existence of human life in its most fragile, dis- abled and dependent state is by no means an implicit mandate to "therapeu- tic obstinacy" or "vitalism." Intensive care in the context of "'brain death'" is one of the clearest possible examples of ethically "extraordinary" ("dis- proportionate") means, which can (and in most cases should) be legitimate- ly foregone. Cases where it could be appropriate to employ such "extraordi- nary" means include brain-dead pregnant women to bring the fetus to via- bility, respect for cultural sensitivities (e.g., in Japan) or personal convictions (as with the mothers of "TK" and other chronically brain-dead children, some orthodox Jews, etc.), empathy in allowing time for family members to

[97] D.A. Shewmon, *The dead donor rule: lessons from linguistics*, in "Kennedy Institute of Ethics Journal," 14, 2004, p. 277-300; D.A Shewmon, E.S. Shewmon, *The semiotics of death and its medical implication*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado C and
D.A. Shewmon, p. 89-114.

arrive and come together to grieve, etc. Issues surrounding justice (who pays for these very expensive treatments) are also important, extremely complex, vary according to each country's health-care structure, and are far beyond the present scope.

That 'brain death' *per se* is not death carries profound implications for the field of transplantation. Regardless of the early history of 'brain death', its post-1968 history has been driven largely by the demands of transplanta- tion: the rapid development and implementation of diagnostic criteria with- out adequate validation, the precipitous revision of statutory death laws with- out a real consensus on the fundamental rationale why 'brain death' should be death, and now the huge momentum of transplantation making everyone reluctant to face squarely the accumulated evidence that the semi-official in- tegrative-unity rationale was all along based on faulty biological assumptions and can no longer serve as an intellectually viable basis for the death of brain- dead organ donors.

But the demise of 'brain death' does not necessarily imply the death-knell to transplantation that so many of its defenders seem to fear. It does, howev- er, imply going about the transplantation procedure in a different way, so that the removal of "vital" organs neither kills nor harms the donor if the donor is not yet dead (ethically analogous to live donors of blood, bone marrow, a single kidney or lobe of liver). At face value this sounds self-contradictory, but it is not – for reasons beyond the scope of this chapter and already de- veloped elsewhere.[99] I emphasize this in conclusion, to dispel the fear that surrounds accepting solid counterevidence against a 38-year-old medico-le- gal sacred cow. To admit that many brain-dead patients are deeply comatose, severely disabled, living human beings is progress, not regress. It will force a refinement in our understanding and diagnosis of death, a clarification in our fundamental philosophical principles regarding human life, and a realign- ment between our understanding and our consciences in dealing with these most vulnerable human lives.

[98] J.P. Lizza, *The conceptual basis for brain death revisited: loss of organic integration or loss of consciousness?*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado C and D.A. Shewmon, p. 52.

[99] D.A. Shewmon, *The dead donor rule: lessons from linguistics*; D.A Shewmon, E.S. Shew- mon, *The semiotics of death and its medical implication, in Brain Death and Disorders of Con sciousness*, edited by C. Machado C and D.A. Shewmon.

*Is Brain Death The Death of The Human Being? On the Current State of Debate**

ROBERT SPAEMANN

I.

Death and life are not primarily objects of science. Our primary access to the phenomenon of life is self-awareness and the perception of other humans and other living beings. Life is the being of the living. "*Vivere viventibus est esse*," says Aristotle. For a living being, not to live means ceasing to exist. Be- ing, however, is never an object of natural science. It is in fact the *primum no- tum* of reason and as such secondarily an object of metaphysical refection. Because Life is the being of the living, it cannot be defined, According to the classical adage *ens et unum convertuntur*, it holds true for every living organ- ism that it is alive precisely as long as it possesses internal unity. Unlike the unity of atom and molecule, the unity of the living organism is constituted by an anti-entropic process of integration. Death is the end of this integration. With death, the reign of entropy begins - hence, the reign of "destructuring," of decay. Decomposition can be stopped by means of chemical mummifica- tion, but this way of preserving a corpse merely holds its parts together in a purely external, spatial sense. Supporting the process of integration with the help of technical appliances, however, is very different. The organism pre- served in this way would in fact die on its own if left unsupported, but being kept from dying, it is kept alive and cannot be declared dead at the same time. In this sense Pope Pius XII declared that human life continues even when its vital functions manifest themselves with the help of artificial processes.

* Prepared for Presentation at the Conference on the "Signs of Death," The Pontifical Acad- emy of Sciences, The Vatican City, February 3-4, 2005 and September 11-12, 2006.

II.

We cannot define life and death, because we cannot define being and non-being. We can, however, discern life and death by means of their physi- cal signs. (Holy Scripture regards breath as the basic phenomenon of life, and for this reason it is often simply identified with life itself). The cessation of breathing and heartbeat, the 'dimming of the eyes', *rigor mortis*, etc are the criteria by which since time immemorial humans have seen and felt that a fel- low human being is dead. In European civilization it has been customary and prescribed by the law for a long time to consult the physician at such times, who has to confirm the judgment of family members. This confirmation is not based on a different scientific definition of death, but on more precise meth- ods to identify the very phenomena noted already by family members. A physician may still be able to discern slight breathing, which escapes a layper- son. Besides the physician could nowadays point out the stopped beating can very well still exist. Due to such sources of error in the perception of death, it is a reasonable traditional rule to let sometime elapse between fast noting this phenomena and the funeral or cremation of the deceased. Similarly, con- sulting a physician serves the purpose of making sure that a human being is not prematurely declared dead, i.e. non-existant.

III.

The 1968 Harvard Medical School declaration[1] fundamentally changed this correlation between medical science and normal interpersonal percep- tion. Scrutinizing the existence of the symptoms of death as perceived by common sense, science no longer presupposes the 'normal' understanding of life an death. It in fact invalidates normal human perception by declaring hu- man beings dead who are still perceived as living. Something quite similar happened once before, in the 17th century, when cartesian science denied what anyone can see, namely, that animals are able to feel pain. These scien- tists conducted the most horrible experiments on animals and claimed that expressions of pain, obvious to anyone, were merely mechanical reactions.

[1] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death*, in "Journal of the American Medical Associa- tion," 205, 1968, p. 337-340.

This incapacitation of perception fortunately did not last. It is returning in different shape, however: namely, by introducing a new definition of death, or rather a definition of death in the first place, in order to be able to declare a human being dead sooner. That way, it would also be possible to define away pain by defining it in terms of the neurological processes which consti- tute its 'infrastructure', and consequently to define everyone as pain-free for whom these diagnostic findings cannot be confirmed. It is merely a matter of transforming the explanation of pain into a definition, in order to be rid of it as pain. Just like pain, its foundation, life, is equally undefineable. The hy- pothesis that the total loss of all brain functions immediately and instanta- neously brings about the death of a human being frequently eludes discus- sion in scientific debates by being transformed into a definition: If the death of a human being and the loss of all brain functions are by definition equat- ed, any criticism of this hypothesis is naturally bound to go nowhere. What remains to be asked is merely whether what was defined in this way is really what all human beings have been used to call 'death', as when Thomas Aquinas, proving the existence of a Prime Mover, a non-contingent Being, etc., concludes his proof with the words: "This is what they all mean when they say 'God'."

Is 'brain death' what they all mean when they say 'death'? According to the Harvard Commission, not at all. The commission intended to provide a new definition, clearly expressing their main interest. It was no longer the in- terest of the dying to avoid being declared dead prematurely, but other peo- ple interest in declaring a dying person dead as soon as possible. Two reasons are given for this third party interest: (1) guaranteeing legal immunity for dis- continuing life-prolonging measures that would constitute a financial and personal burden for family members and society, alike, and (2) collecting vi- tal organs for the purpose of saving the lives of other human beings through transplantation. These two interests are not the patient's interests, since they aim at eliminating him as a subject of his own interests as soon as possible. Corpses are no such subjects any more. The first of the two interests men- tioned is incidentally bound to an erroneous premise and a correspondingly problematic practice of the judiciary: It presupposes that for every human be- ing not declared dead, life prolonging measures are indicated always and without exception. Where this premise is dropped, the interest in declaring death at an early point ceases to exist. What remains is the second interest. This interest is self-contradictory, insofar as it requires on the one hand to col- lect live organs, for which reason the dying person needs to be kept alive ar-

tificially, while on the other hand the dying person has to be declared dead, so that the collection of those organs does not have to be considered an act of killing.

IV.

The fact that a certain hypothesis regarding the death of a human being is in the interest of other people who would benefit from the verification of this hypothesis, does not prove its falsity. It must alert us, however, to be ex- tremely critical, and it requires setting the burden of proof for this hypothe- sis very high. This holds true more than ever when the hypothesis is immu- nized underhand by turning it into a definition. Precisely because nominal definitions are neither true nor false, the question of whose interests they serve gains relevance. The strategy of immunization thus has a counterpro- ductive effect. The legislation of my country allows for a physician's conflict of interests, insofar as prior to a transplantation, death has to be determined by physicians who themselves are not involved in the transplantation. But un- fortunately, transplantation physicians did have their share in drafting the cri- teria for the determination of death. Having as little to do with the formula- tion of the criteria for the determination of death as with their application ought to be in the moral interest of transplantation physicians regarding their personal integrity - even if not in the professional interest of transplantation medicine, although the professional interest of transplantation medicine, considered as it is in itself, is a highly moral interest, the interest in saving the lives of human beings. It has to be ensured, however, that saving lives does not happen at the expense of the lives of other people. A transplantation physician professionally sides with the recipient, not the donor of organs.

It is a fact that since 1968, the consensus about the new definition of death has not been consolidated; to the contrary, objections against it have in- creased. Ralf Stoecker states in his 1999 habilitation thesis *Der Hirntod* (*'Brain Death'*) that the switch-over from cardiac death to 'brain death' is more contended today than thirty years ago.[2] The arguments against 'brain death' are brought forward not only by philosophers, and, especially in my country, by leading jurists, but also by medical scientists, e,g. the American

[2] R. Stoecker, *Der Hirntod. Ein medizinethisches Problem und seine moralphilosophische Trans- formation*, Freiburg/München, Verlag Karl Alber, 1999, p. 37.

neurologist Shewmon, prominent as a radical advocate of 'brain death' still in 1985, until his own medical research convinced him of the opposite.

V.

The observer of the discussion is bound to discover that it suffers from a marked asymmetry. The proponents of the new definition argue from a 'po- sition of strength'. They feel that it is an unreasonable demand to waste more time with arguments, aware that they have the "normative power of the fac- tual" on their side, i.e. an established medical practice which meanwhile has already become routine, as well as, for believers, the blessing of the Church (which, however, was categorically called into question last year by a public statement of the Cardinal Archbishop of Cologne). They do not even dis- tantly make the same effort dealing with the arguments of their critics as vice versa. Consequently, the weight of the arguments has shifted for every unbi- ased observer more and more in favor of the skeptics. I myself have to con- fess that their arguments have meanwhile convinced me. Life and Death are not the property of science, hence it is the duty of scientists to convince or- dinary laypeople of their viewpoint, who are endowed with a certain degree of intelligence. Where scientists refuse to make this effort under the as- sumption that they can use arguments of authority instead, their case is in- deed in a sorry state. In the following, I would in fact like to make my argu- ment against the new definition of death. What it defines is not *quod omnes dicunt mortem*.

VI.

The proponents of the thesis that the loss of all brain functions is identi- cal with the death of the human being divide into two separate subgroups. The first group distinguishes between the life of the human being and human life, i.e., the life of a person. According to them, the term 'human life' should only be used as long as mental processes of specifically human nature can be discerned. When the organic basis of such processes ceases to exist, the hu- man being is no longer a person, hence his or her organism is at other peo- ple's disposal to use for their purposes. Consequently, a total loss of all brain functions is not even required at all. Sufficient is the failure of those brain ar-

eas that constitute the ‘hardware’ for these mental acts. People in persistent vegetative state are thus dead as persons. Not only is this position incompat- ible with the doctrines of most high religions, in particular of Judaism and Christianity; it also contradicts the tenets of today’s medical orthodoxy. A well-known proponent of this position is Australian bioethicist Peter Singer. The second group starts from the assumption that we can only speak of the death of a human being when the human organism as whole has ceased to ex- ist, i.e. when the integration process constituting the unity of the organism has come to an end. According to this second group’s thesis, this process is terminated with the total loss of all brain functions, assuming the brain to be the organ responsible for integration. Hence, according to the views of this group, death of the brain is the death of the human being, if the underlying hypothesis is correct, so must be the conclusion, and even the Church would have no reason to defy this conclusion. But obviously, the hypothesis is not correct, and those who wish to adhere to the conclusion are consequently forced to draw closer to the unorthodox theory of the first group, i.e. the cor- tical death hypothesis.

VII.

The hypothesis of at least extensional identity of the total loss of brain functions and the death of the human being is incorrect for several reasons. First of all, it contradicts all appearance, i.e. normal perception, similar to the Cartesian denial of pain in animals. When a German anesthesiologist writes, “Brain-lead people are not dead but dying,” and that even after thirty years in the profession she could not convince herself of the opposite of what every- body can see, then her statement stands for many others. One of the most well-known German neurologists, Prof. Dichgans, head of the Neurologis- che Universitätsklinik in Tubingen, who had until then not followed the lat- est criticism of the ‘brain death’ concept within the medical community, told me recently that he personally was not prepared to diagnose death based on standard neurological criteria, and therefore did not participate in the deter- mination of death. German intensive care physician Peschke reports that ac- cording to his investigations, nurses in transplantation units are prepared nei- ther to donate organs nor receive donated organs. What they see on a daily basis makes it impossible for them to become part of this practice themselves. One of these nurses writes: “When you stand right there, and an arm comes

up and touches your body or reaches around your body - this is terrifying." And the fact that the allegedly dead person is usually given anesthesia, so that the arm stays down, does not contribute to putting less trust in one's own senses. Does one anesthetize corpses? This is merely a suppression of vege- tative responses, goes the argument. Yet a body capable of vegetative re- sponses requiring complicated coordination of muscle activity is obviously not in that state of disintegration which would entitle us to say that it is not alive, i.e. does not exist any more.

VIII.

Here the reasons of common sense converge with those advanced by medical science. Thus it was already pointed out by Dr. Paul Byrne[3] in 1979 that it is unjustified to equate the irreversible loss of all brain functions with 'brain death', i.e. with the end of the existence of the brain. Likewise, we do not equate the cessation of heartbeat with the destruction of the heart. We know today that in some cases this loss of function is reversible. But it is on- ly reversible because the heart precisely does not cease to exist when it ceas- es to function. And only because the cessation of breathing was not equated with the 'death of the lung', it became possible to utilize mechanical ventila- tors which restarted those functions.

Based on considerations of this kind, e.g. P. Safer and others began to work on the resuscitation of brain function in brains considered dead by stan- dard criteria. The reply that the loss of function in resuscitated brains had just not been irreversible, makes for a circular argument. Irreversibility is ob- viously not an empirical criterion, since it can always be determined only ret- rospectively. Just because we assume that the brain still exists, we try to re- suscitate its function.

Similarly circular is the reasoning in the question what constitutes "total loss of brain function." The proponents of 'brain death' reject the substitu- tion of this term by 'loss of all brain functions' on the grounds that this would also pertain to 'peripheral brain functions' which can survive the brain as a whole. What are such 'peripheral functions'? The Minnesota cri- teria for this are different from the British criteria, and some authors already

[3] P.A. Byrne, S. O'Reilly, P.M. Quay, *Brain Death - An Opposing View Point*, in "Journal of the American Medical Association," 242, 1979, p. 1985-1990.

declare brain stem activity peripheral when the cortex has ceased functioning. Anything can apparently be regarded as peripheral which is not identical with the integrative function of the brain for the organism as a whole. But the question had precisely been to prove just this integrative functional So Paul Byrne's words are arguably still valid: "There is no limit to what real functions may be declared peripheral when the only nonperipheral function is imaginary."

IX.

Is it justified to call the somatically integrative function of the brain "imaginary"? Among the authors who claim this and give reasons for their views, maybe the most important one is Alan Shewmon. A summary of his empirical research and theoretical considerations can be found in his essay *The Brain and Somatic Integration: Insights into the Standard Biological Rationale for equating, 'brain death' with Death*,[4] published in 2001. Here I will only present the abstract of this essay, which of course contains neither empirical evidence nor theoretical arguments, only the theses.

The mainstream rationale for equating 'brain death' (BD) with death is that the brain confers integrative unity upon the body, transforming it from a mere collection of organs and tissues to an organism as a whole. In support of this conclusion, the impressive list of the brain's myriad integrative functions is often cited. Upon closer examination and after operational definition of terms, however, one discovers that most integrative functions of the brain are actually not somatically integrating, and, conversely, most integrative functions of the body are not brain mediated. With re- spect to organism-level vitality, the brain's role is more modulatory than constitutive, enhancing the quality and survival potential of a presupposed living organism. Inte- grative unity of a complex organism is an inherently nonlocalizable, holistic feature involving the mutual interaction among all the parts, not a top-down coordination imposed by one part upon a passive multiplicity of other parts. Loss of somatic in- tegrative unity is not a physiologically tenable rationale for equating DB with death of the organism as a whole.[5]

[4] A. Shewmon, *The Brain and Somatic Integration: Insights into the Standard Biological Ratio nale for Equating Brain Death with Death*, in "Journal of Medicine and Philosophy," 26, 2001, p. 457-478.
[5] Ibid., p. 457.

X.

From Dr. Shewmon's text I will only quote a short paragraph:

Integration does not necessarily require an integrator, as plants and embryos clearly demonstrate. What is of the essence of integrative unity is neither localized nor replaceable - namely the anti-entropic mutual interaction of all the cells and tis- sues of the body, mediated in mammals by circulating oxygenated blood. To assert this non-encephalic essence of organism life is far from a regression to the simplistic traditional cardio-pulmonary criterion or to an ancient cardiocentric notion of vi- tality. If anything, the idea that the non-brain body is a mere 'collection of organs' in a bag of skin seems to entail a throwback to a primitive atomism that should find no place in the dynamical-systems-enlightened biology of the 1990s and twenty-first century.[6]

XI.

A nonmedical person, trained in the theory of science and wishing to form an objective opinion about the *status quaestionis*, must strive to evaluate the arguments brought forth in the debate. Where results of empirical research are concerned which he or she has no way of verifying independently, it is necessary to confront them with the counter-arguments. Insofar as these counter-arguments are of an empirical nature as well and challenge the accuracy of the presented research results, any judgment is to be abstained from until further empirical verification. As far as a theoretical interpretation of the results is concerned, he or she is qualified verify and evaluate it.

Regarding the findings presented by Dr. Shewmon, I am not aware of any criticism targeting the core of his argumentation. I conclude from two facts that such criticism indeed does not exist:

When Shewmon presented his research results at the Third International Symposium on Coma and Death, in Havana, Cuba, February 22-25, 2000,[7] attended largely by neurologists and bioethicists, there was surprisingly broad acceptance. What ensued was a shift of the domain of the debate from

[6] Ibid., p. 473.

[7] D.A. Shewmon, *Seeing is believing: videos of life 13 years after 'brain death', and conscious ness despite congenital absence of cortex*, presented at the *3rd International Symposium on Coma and Death*, Havana, Cuba, February 22-25, 2000.

the medical to the philosophical arena, with the defenders of ‘brain death’ appealing exclusively to consciousness-based concepts of personhood rather than the previously standard medical rationale of bodily integrity.

In fall 2002, the “American National Catholic Bioethics Quarterly” pub- lished an article by editor-in-chief Edward J. Furton,[8] which is dedicated ex- clusively to the debate with Alan Shewmon. In this article, Dr. Shewmon’s empirical research results are not disputed, nor is any reference made to lit- erature which would justify such doubts. From this I conclude that indeed there Is no such literature.

All the more interesting is Furton’s article itself, which defends the equation of ‘brain death’ with death against Shewmon. I will conclude my own remarks with a critical report about this article, beginning with a sum- mary: Furton’s primarily philosophical arguments in favor of ‘brain death’ convinced me more than anything else of the opposite. The reason is that Furton is only able to sustain his thesis of ‘brain death’ as the death of the human being by distinguishing between the death of the human being as a person and the death of the human being as a living being. He writes: “Al- though the difference between the death of the person and the decay of the body had long been obvious, it is only in our time that the difference be- tween the life of the person and the life of the body has become apparent.” This, now, is exactly the position of Peter Singer, and it is incompatible with the belief of most religions, and certainly with that of Christianity. If Church authorities cautiously accepted the premise of ‘brain death’, this was always done under the premise that the brain is responsible for somat- ic integration, the loss of the brain functions hence being identical with the death of the organism. It is beyond the scope of religious authority to judge the validity of this premise. Where the premise becomes doubtful, the con- clusion ceases to apply.

Furton would like to hold on to the conclusion, even though he abandons the premise under the impression of Alan Shewmon’s arguments, his appeal to papal authority is, therefore, not justified, and it is surprising that he makes such excessive use of the argument of authority in his debate with Shewmon. Just because the Pope bases his own equally hypothetical conclusion on it does not mean that a scientific hypothesis is thereby withdrawn from further scientific discourse.

[8] E.J. Furton, *Brain Death, the Soul and Organic Life*, in “American National Catholic Bioethics Quarterly,” 2002.

XII.

Otherwise the Ptolemaic world view would have been dogmatized for- ever, just because the Church drew conclusions with religious and practical relevance from it while it was generally accepted. At the same time Furton himself concedes in his essay that "the determination of death does not fall under the expertise of the Church, but belongs to the physician who is trained in this field." (I would like to render this more precisely: The physi- cian is qualified to determine the existence of pre-defined criteria for death. The discourse about these criteria themselves falls into the domain of philosophers and philosophizing theologians after they have received the necessary empirical information from the medical profession. Furton bases his argument on the Aristotelian-Thomistic doctrine of the soul in connec- tion with the teaching of the Church, dogmatized after the Council of Vienne 1311-1312, according to which the human soul is only one, from which fol- lows that the *anima intellectiva* is at the same time the *forma corporis*. From this doctrine, however, Furton draws a conclusion which is diametrically op- posed to the intention of St. Thomas as well as the Council of Vienne. Thomas assumes that the human being initially possesses a vegetative and then an animal soul, and that the spiritual soul is created only on the 40th day of pregnancy, and not in parallel with the other two souls but in their stead, so that it is now the spiritual soul that simultaneously fulfills the vegetative and the sensorimotor functions. This is drastically different from Aristotle, for whom *nous*, reason, is not part of the human soul, but *thyraten*, entering the human being from outside. St. Thomas, by the way, excludes Jesus Christ explicitly from successive animation: The incarnation in the moment of his conception presupposes that Jesus' soul must have been a human soul in the full sense from the very beginning. The Church, herein following science, has given up the idea of successive animation long ago and regards not only Je- sus, but any human being as a person from the moment of conception, with his or her soul being an *anima intellectiva* - even though the newborn infant is not yet capable of intellectual acts. This inability is due to the lack of suf- ficiently developed somatic 'infrastructure'. Similarly, a pianist 'cannot' play the piano when there is no piano available. Just as the pianist nonetheless re- mains a pianist, the soul of the human being is an *anima intellectiva* even when it is factually unable to think. The being of man is not thinking but liv- ing: "*Vivere viventibus est esse*." Furton's way of thinking is radically nomi- nalistic. For him, a personal soul exists only as long as an individual is capa-

ble of specifically personal acts. For him, the reality of the soul of the human being is not in allowing man to exist as a living being, it is not *forma corporis* but the form of the brain and only indirectly the form of the body. "The soul is... what enlivens a material organ, namely the brain, and from there enlivens the rest of the human body." (This view was rejected already in 1959 by the Würzburg-based neurologist Prof. Joachim Gerlach, for whom the error in the equation of 'brain death' and the death of the individual consists in "re- garding the brain as the seat of the soul." Similarly, Paul Byrne wrote already in 1979: "'Brain function' is so defined as to take the place of the immateri- al principle or soul of man.") Furton identifies that which Thomas calls *in- tellectus* with factual intellectual consciousness. He does not conclude from the obvious continued existence of a living human organism that the personal soul, which is the forma of the human body, is still alive, but contrariwise: be- cause a human being is not capable of intellectual acts any more, the soul has left him and he is, as a person, dead. The fact that the organism as a whole is obviously still living doesn't play any role. Without actual brain function, the human organism is nothing other than a severed organ, which also still shows expression of life.

This position is consequent. It largely coincides with Peter Singer and Derek Parfit, for whom persons exist only as long as they are capable of per- sonal acts, hence sleeping people, e.g., are not persons. Under the weight of the arguments of Shewmon and others, the group of medically and theolog- ically 'orthodox' defenders of 'brain death' is apparently disintegrating.

XIII.

In the light of the untenability of the thesis of the integrative function of the brain, the identification of 'brain death' and the death of the human be- ing can only be held up if the personality of man is disconnected from being a human in the biological sense, which is what Singer, Parfit and Furton are doing. To do this under reference to the doctrine of St Thomas is absurd in- deed. Furton avails himself of an equivocation in the term *intellectus* when he claims that being a human consists in a connection of intellect and matter, seemingly as though Thomas understood "intellect" in terms of actual think- ing rather than the capacity to think. This capacity belongs to the human soul, and this soul is *forma corporis* as long as the disposition of the body's matter permits it. Instead of concluding: where there is no longer any thinking, the

forma corporis of the human being has disappeared, we can thus only con- clude: as long as the body of the human being is not dead, the personal soul is also still present. Only the second conclusion is compatible with Catholic doctrine as well as the tradition of European philosophy. Furton's adventur- ous conclusion to declare a human being dead when his or her specifically human attributes do not manifest themselves any more, is contrary to all im- mediate perception. Even Peter Singer and Derek Parfit are still closer to the phenomena when they do declare the person expired, but do not already for this reason consider the human being dead.

I conclude with the words of three German jurists who wrote after im- mersing themselves in the medical literature: "To be correct, the 'brain death' criterion is only suited to prove the irreversibility of the process of dying and to thus set an end to the physician's duty of treatment as an attempt to delay death. In this sense of a treatment limitation, the 'brain death' criterion is nowadays likely to find general agreement." (Prof. Dr. Ralph Weber, Ros- tock).

"The brain dead patient is a dying human being, still living in the sense of the Basic Constitutional Law [scil_ of the Federal Republic of Germany, ESSJ Art 2, II, 1 99]. There is no permissible way to justify under constitu- tional law why the failure of the brain would end human life in the sense of the Basic Constitutional Law. Accordingly, brain dead patients have to be correctly regarded as dying, hence living people in the state of irreversible brain failure." (Prof. Dr. Wolfram Höfeing, Bonn).

"It is impossible to adhere to the concept of 'brain death' any further... There is no dogmatic return to the days before the challenges to the concept of 'brain death'" (Dr. Stephan Rixen, Berlin).

XIV.

After all that has been said, for anybody who is still doubtful, the princi- ple applies, according to Hans Jonas, "*In dubio pro vita*"; Pius XII declared just that in case of insoluble doubt, one can resort to presumptions of law and of fact. In general, it will be necessary to presume that life remains.[9]

[9] Pius XII, *To an International Congress of Anesthesiologists, Nov. 24, 1957*, in *The Pope Speaks*, vol. 4, n. 4, 1958, p. 393-398.

A Law of Life, Legality vs. Morality

WOLFGANG WALDSTEIN

As far back as we have sources concerning legal problems we find the clear awareness of the fact that man finds himself in a legal order not produced by man himself, but being part of the creation of the world. But equally there is evidence of the sad fact that political power, be it of a tyrant or a majority of a people, again and again throughout the history of mankind also disregarded this law by enacting laws which violate natural law. One of the most impressing examples is Antigone of Sophocles (496-406 BC). Antigone, who had, transgressing a law of the king Kreon, buried her brother, was asked by the king: "… you dared to trangress these laws?" She replied:

Yes, for it was not Zeus who made this proclamation, nor was it Justice …, nor did I think your proclamation strong enough to have the power to overrule, mortal as they were, the unwritten and unfailing ordinances of the gods. For these have life, not simply today and yesterday, but for ever, and no one knows how long ago they were revealed. For this I did not intend to pay the penalty among the gods for fear of any man's pride.[1]

Cicero, who was murdered 43 BC because of his fight for true legality, writes in his work about the Laws:

Justice is one; it binds all human society, and is based on one Law … Whoever knows not this law, whether it has been recorded in writing anywhere or not, is with- out Justice.[2]

[1] Sophokles, *Antigone*, edited by G.P. Goold, Cambridge, Harvard University Press, 1949, 447-460.
[2] Cicero, *De legibus* [*Laws*] 1, 42.

He then exemplifies the consequences of such ignorance in those who ac- tually make laws:

… if the laws were founded on the decrees of peoples, …, then law would sanc- tion robbery and adultery and forgery of wills, in case these acts were approved by the votes and decrees of the populace. … But in fact we can perceive the difference between good laws and bad by referring them to no other standard than Nature.[3]

In an especially solemn way Cicero speaks about this Law in his work *The Republic*. The importance of this text, directed against the position of the Sceptic Academy of Karneades, and by that also against all scepticisms of our own times, urges me to quote it in full. The passage from Ciceros *De re pub-lica* 3, 33 reads as follows:

True law is right reason (or order[4]) in agreement with nature; it is of universal application, unchanging and everlasting; … It is a sin to try to alter this law, nor is it allowable to attempt to repeal any part of it, and it is impossible to abolish it entire- ly. We cannot be freed from its obligations by senate or people, and we need not look outside ourselves for an expounder or interpreter of it. And there will not be differ- ent laws at Rome and Athens, or different laws now and in the future, but one eter- nal and unchangeable law will be valid for all nations and all times, and there will be one master and ruler, that is, God (the Latin text says here deus in the singular), over us all, for he is the author of this law, its promulgator and its enforcing judge. Who- ever is disobedient (to him, cui, omitted in the translation) is fleeing from himself and denying his human nature, and by reason of this very fact he will suffer the worst penalties, even if he escapes what is commonly considered punishment.[5]

The disregard for this law has in our times led to results which Cicero could not have imagined. Tyrannical totalitarian acts of barbarism of the last century provoked the General Declaration of Human Rights in 1948 and the European Convention of Human Rights in 1950. In spite of this Declaration

[3] Ibid., 1, 43-44.

[4] *Ratio* in this context as in many others evidently means "order." Later on it is, as at the be ginning, rendered by *lex*. F. Cancelli, Ed. del Centro di Studi Ciceroniani, Firenze 1979, p. 408, af firms in his ample note 22 to the text that *ratio* in this context means "la legge eterna divina […], fondamento inconcutibile (così) dell'etica." See also W. Waldstein, *Teoria generale del diritto*, Ro ma, Pontificia Università Lateranense, 2002, p. 95.

[5] Cicero, *De re publica, De legibus*, trans. by C.W. Keyes, The Loeb Classical Library, London, Heinemann, 1966, p. 211.

and Convention laws were passed all over the world not only versus morality but also versus solemnly proclaimed human rights and by that versus natural law. On the basis of all experiences since prechristian antiquity Pope John Paul II felt compelled to say in his encyclical *Evangelium vitae*:

Precisely in an age when the inviolable rights of the person are solemnly pro- claimed and the value of life is publicly affirmed, the very right to life is being de- nied or trampled upon, especially at the more significant moments of existence: the moment of birth and the moment of death.[6]

He then deals with acts of legislation concerning human life and says:

This is what is happening also at the level of politics and government: the origi- nal and inalienable right to life is questioned or denied on the basis of a parliamen- tary vote or the will of one part of the people – even if it is the majority. This is the sinister result of a relativism which reigns unopposed: the 'right' ceases to be such, because it is no longer firmly founded on the inviolable dignity of the person, but is made subject to the will of the stronger part. In this way democracy, contradicting its own priciples, effectively moves towards a form of totalitarianism.[7]

What the Pope says, is not only the opinion of Catholic faith, as is often said in order to devalue his statements. This was already seen clearly in pre-cristian antiquity since Plato, Aristotle and especially Cicero with the natural light of reason. Therefore what the Pope says is true for all mankind, independent of any religeous beliefs. The consequences for the legality, which is claimed to still exist, are described by the Pope in the following way:

The appearance of the strictest respect for legality is maintained, at least when the laws permitting abortion and euthanasia are the result of a ballot in accordance with what are generally seen as the rules of democracy. Really, what we have here is only the tragic caricature of legality; the democratic ideal, which is only truly such when it acknowledges and safeguards the dignity of every human person, is betrayed in its very foundations.[8]

He then solemnly affirms:

[6] John Paul II, *Evangelium vitae*, § 18.
[7] Id.
[8] Ibid., § 20.

No circumstance, no purpose, no law whatsoever can ever make licit an act which is intrinsically illicit, since it is contrary to the Law of God which is written in every human heart, knowable by reason itself, and proclaimed by the Church.[9]

At the end of the encyclical the Pope states again:

I repeat once more that a law which violates an innocent person's natural right to life is unjust and, as such, is not valid as a law. For this reason I urgently appeal once more to all political leaders not to pass laws which, by disregarding the digni- ty of the person, undermine the very fabric of society.[10]

There is no other way back to a legitimate state than to really respect the inviolable human rights.
The special problem, which is the subject of this congress, arose at the moment when in 1968 an Ad Hoc Committee of the Harvard Medical School to Examine the Definition of 'Brain Death', published its results.[11] The purpose for the identification of the moment of death of a person with 'brain death' was clearly "to increase the availability of organs for transplants." Exactly concerning this purpose the Holy Father stated in the encyclical *Evan-gelium vitae* in connection with the problem of euthanasia the following:

Nor can we remain silent in the face of other more furtive, but no less serious and real, forms of euthanasia. These could occur for example when, in order to in- crease the availability of organs for transplants, organs are removed without re- specting objective and adequate criteria which verify the death of the donor.[12]

It is clear that one wanted to establish 'brain death' as such an "objective and adequate" criterion. Scientists in this field even succeeded in convincing the Holy Father about this in such a way that he, in his address to the par-

[19]Ibid., § 62.
[10] Ibid., § 90.
[11] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death*, in "Journal of the American Medical Association," 205, 1968, p. 337-340.
[12] John Paul II, *Evangelium vitae*, § 15. See also nr. 11 last paragraph: "All this explains, at least in part, how the value of life can today undergo a kind of 'eclipse', even though conscience does not cease to point to it as a sacred and inviolable value, as is evident in the tendency to dis guise certain crimes against life in its early or final stages by using innocuous medical terms which distract attention from the fact that what is involved is the right to life of an actual human person."

ticipants of the XVIII International Congress of the Transplantation Society on August 29, 2000, said the following:

It is a well-known fact that for some time certain scientific approaches to ascer- taining death have shifted the emphasis from the traditional cardio-respiratory signs to the so-called 'neurological' criterion. Specifically, this consists in establishing, ac- cording to clearly determined parameters commonly held by the international sci- entific community, the complete and irreversible cessation of all brain activity (in the cerebrum, cerebellum and brain stem). This is then considered the sign that the in- dividual organism has lost its integrativ capacity.[13]

Then the Holy Father goes on to say:

Here it can be said that the criterion adopted in more recent times for ascer- taining the fact of death, namely the complete and irreversible cessation of all brain activity, if rigorously applied, does not seem to conflict with the essential elements of a sound anthropology. Therefore a health-worker professionally responsible for ascertaining death can use these criteria in each individual case as the basis for ar- riving at the degree of assurance in ethical judgement which moral teaching de- scribes as 'moral certainty'. This moral certainty is considered the necessary and suf- ficient basis fo an ethically correct course of action. Only where such certainty ex- ists, and where informed consent has already been given by the donor or the donor's legitimate representatives, is it morally right to initiate the technical procedures re- quired for the removal of organs for transplant.[14]

In the passage prior to the quoted the Pope made an important reservation.
He said:

With regard to the parameters used today for ascertaining death – Whether the 'encephalic' signs or the more traditional cardio-respiratory signs – the Church does not make technical decisions. She limits herself to the Gospel duty of comparing the data offered by medical science with the Christian understanding of the unity of the person, bringing out the similarities and the possible conflicts capable of endanger- ing respect for human dignity.[15]

[13]John Paul II, *Address of 29 August 2000 to the 18th International Congress of the Transplantation Society*, in "L'Osservatore Romano," Vatican City, August 2000, p. 1-2 (www.vatican.va/holy_father/john_paul_ii/speeches/2000/jul-sep/documents/hf_jp-ii_spe_20000829_transplants_en.html).

This is very important, because it makes clear that the Holy Father took up the opinion which at that time seemed to be "commonly held by the in- ternational scientific community." In the meantime "the data offered by medical science" in favour of the 'brain death' criterion have been shown to be questionable in many respects. This has become evident already by the re- sults which competent scientists in the field of medicine have offered to this congress. It therefore can not be said anymore that the 'brain death' criteri- on is still "commonly held by the international scientific community" as valid. Serious doubts came even to scientists who through many years had practised "the technical procedures required for the removal of organs for transplant." I must not repeat what has been said already. To say that these doubts are on- ly due to ignorance or insufficient information, as many still believe, would be absurd. All the arguments already presented make clear that the "moral certainty," which is required for ascertaining death when 'brain death' can be diagnosed, is far from being accepted commonly. Those, who still believe that "moral certainty" exists, will, according to my experience, hardly accept arguments for the contrary. But those who can not see "moral certainty" are responsible according to their own conscience.

In the legal science it is accepted that "the complete and irreversible ces- sation of all brain activity" marks the beginning of the irreversible dying process. A dying person, however, is not yet dead. I believe that no one would argue that a brain dead person is in such a way dead that this person could be buried right away. Why not? Can one be more dead than dead in order to be ready for being buried? In legal science it is therefore argued that the death of a person can not be attested until both criteria, "the complete and irreversible cessation of all brain activity" and the "cardio-respiratory signs" occur. The dying person is not yet a dead person. Therefore, when for in- stance "a beating heart … is stopped by the surgeon just prior to excision,"[16] that is without any doubt an act of killing a dying person. On this jurists gen- erally agree. A very well founded analysis of the problems was conributed by Prof. Ralph Weber from the University of Rostock.[17] In accordance with other prominent constitutionalists he can show convincingly that a brain dead

[16] P.A. Byrne, W. F. Weaver, *Brain Death Is Not Death*, in *Brain Death and Disorders of Con sciousness*, edited by C. Machado and D.A. Shewmon, New York, Kluwer Academic/Plenum Pub lishers, 2004, p. 43-49.

[17] R. Weber, *Der Hirntodbegriff und der Tod des Menschen*, in "Zeitschrift für Lebensrecht," 11, 2002, p. 94-106.

man, according to the fundamental rights, has to be regarded as a living per- son until the "cardio-respiratory signs" occur. But also surgeons who have practised that have come to see what they do, as was shown by earlier speak- ers. Other surgeons still do it, and, as they assert, with good conscience. The transplantation legislation allows that. It is argued that the good and humane purpose justifies this act.

The question, however, arises, whether good conscience for itself can guarantee the rightness of an act, even if this act is allowed by law and has a good purpose. Here I have to remember that even the entire German bish- ops conference collaborated many years with the German abortion system with good conscience. Archbishop Dyba, who openly criticized that, was marked as fundamentalist by the others. It took the Holy Father quite an ef- fort to convince the German bishops that this collaboration is incompatible with the teaching of the Church.

In the discussion of the proposed German *Transplantationsgesetz* [*Trans- plantation Law*], the German professor for medicine Dr. Linus Geisler said in the commission of the German *Bundestag* [*Parliament*] on June 28, 1995, the following:

> 1. The critical valuation of the 'brain death' in view of a new transplantation-law does not aim at questioning transplantation-medicine. The purpose is to ensure that this branch of medicine can act within a frame which is scientifically, ethically, anthropologically, and juridically unobjectionable.
>
> 2. Declaring the moment of death is not an academic question: With the acknowledgement of 'brain death' as death of man the brain dead patient is deprived of his personal rights which are guaranteed by human rights ["grundrechtlich verankert" in German means those human rights which are constitutionally guaranteed]... To dying persons only the rights of dead persons are granted.
>
> 3. The search for an answer to the question: "When is a man dead?" is search for a truth which is not only of fundamental significance for transplantation-medicine, but at the same time for the image of man in our society.

He then goes on to say that with the methods of natural sciences no an- swers can be found to many questions concerning the status of the dying per- son. Man is more than his brain. As an unique and non-interchangeable crea- ture he is not only represented by his brain, but also by his body, which in the case of the brain dead lives still at 97%. The dangerousness of an image of man which measures the being of man only by the performances of the brain

is obvious. To this he adds the remark: I should say that for physicians the principle *in dubio pro vita* ought to be valid for all men.
In this context it is important to remember on what kind of scientific basis the *Report* of the Ad Hoc Committee of the Harvard Medical School was formulated. As Walt F. Weaver and Paul A. Byrne have reported the first words of this report are the following: "Our primary purpose is to define irreversible coma as a new criterion for death." The report continues:

There are two reasons why there is need for a definition. (1) Improvements in resuscitative and supportive measures have led to increased efforts to save those who are desperately injured. Sometimes these efforts have only partial success so that the result is an individual whose heart continues to beat but whose brain is irreversibly damaged. The burden is great on patients who suffer permanent loss of intellect, on their families, on the hospitals, and on those in need of hospital beds already occu- pied by these comatose patients. (2) Obsolete criteria for the definition of death can lead to controversy in obtaining organs for transplantation.[18]

I am not competent to give a comment to these reasons from the point of view of medical science. This was already done by competent scientists. My own comment to reason (1) is that it exactly corresponds with the reasons given in 1920 by the famous German jurist professor Dr. jur. et phil. Karl Binding on the basis of juridical positivism,[19] for which human rights and natural law do not exist. For Nazi Germany the reasons given by Binding were the very much welcomed theoretical fundament for the euthanasia-program. It is not surprising that the *Zentralorgan der Internationalen Vere-inigung Sozialistischer Ärzte* in December 1934 endorsed the ideas of Binding completely and urgently recommended the reading of his booklet.[20] The (2) reason given by the Harvard report is clearly to cut off controversies which could be an obstacle for "obtaining organs for transplantation." It is completely clear that the definition did in no way aim for the truth concerning the time of death. The new definition has mainly to serve the purpose "to increase the availabilty of organs for transplants" when "organs are

[18] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical School to Examine Brain Death*, p. 337.
[19] Together with Dr. med. Alfred Hoche, Freiburg. The German title of the book is *Die Freiga- be der Vernichtung lebensunwerten Lebens. Ihr Maß und ihre Form*, Leipzig 1920.
[20] F. Limacher-Bern, *Vernichtung lebensunwerten Lebens*, in "Internationales ärztliches Bul letin," Dezember 1934, Nr. 12, Prague, Jahrgang I-VI (1934-1939), Reprint, p. 181-183.
[21] John Paul II, *Evangelium vitae*, § 15.

removed without respecting objective and adequate criteria which verify the death of the donor."[21] This clearly involves at least a "furtive, but no less serious and real, form of euthanasia." But the "pro transplant physician Robert Truog, in an article entitled *Is It Time To Abandon Brain Death*,[22] dared to go a step towards truth stating the following: "The most difficult challenge for this proposal would be to gain acceptance of the view that killing may sometimes be a justifiable necessity for procuring transplantable organs." That is at least honest.

The answer to this is given in the two passages from *Evangelium vitae* which I had quoted earlier: "No circumstance, no purpose, no law whatsoever can ever make licit an act which is intrinsically illicit, since it is contrary to the Law of God which is written in every human heart, knowable by reason itself, and proclaimed by the Church."[23] And at the end of the encyclical the Pope states again: "I repeat once more that a law which violates an innocent person's natural right to life is unjust and, as such, is not valid as a law. For this reason I urgently appeal once more to all political leaders not to pass laws which, by disregarding the dignity of the person, undermine the very fabric of society."[24] There is no other way back to a legitimate state than to really respect the inviolable human rights. Doubtlessly we are faced with the fact "of a tragic obscuring of the collective con-science."[25] Therefore it will be one of the main tasks for the future to reactivate this "moral conscience," without which a humane future will be im- possible. Hence I would like to conclude with a passage from the end of the Encyclical:

[22] R.D. Truog, *Is it Time to Abandon Brain Death?*, in "Hastings Center Report," 27, 1, 1997, p. 29-37. Quoted here from the mentioned paper by P.A. Byrne, W.F. Weaver, *Brain Death Is Not Death*, in *Brain Death and Disorders of Consciousness*, edited by C. Machado and D.A. Shewmon, New York, Kluwer Academic/Plenum Publishers, 2004, p. 43-49.

[23] John Paul II, *Evangelium vitae*, § 62.

[24] Ibid., § 90.

[25] Ibid., § 70. See also § 4.

When the Church declares that unconditional respect for the right to life of every innocent person – from conception to natural death – is one of the pillars on which every civil society stands, she "wants simply to promote a human State. A State which recognizes the defence of the fundamental rights of the human person, especially of the weakest, as its primary duty."[26] / The Gospel of life is for the whole human society / There can be no true democracy without a recognition of every
person's dignity and without respect for his or her rights.[27]
With the Holy Father I can only wish: "may a new culture of love and sol- idarity develop for the true good of the whole of human society."[28]

[26] Here the Pope quotes a speech of 1987: John Paul II, *Address to Pariticpants in the Study conference on The Right to Life in Europe Dec. 18, 1987*, in "Insegnamenti," 10, 3, 1987, p. 1446.[27]Jouhn Paul II, *Evangelium vitae*, § 101. The English translation has a difficulty with
gender, which the Latin does not have.
[28] Id.

Controversies on Brain Death in Japan and our Seven-Year Experience After the Enforcement of the Organ Transplantation law

YOSHIO WATANABE

Introduction

In 1990, the Japanese Government appointed a special committee in preparation for the legalization of organ transplantation from so-called brain- dead individuals. Member s of the committee included physicians, jurists, philosophers, sociologists, and so forth. For the following two years, they dis- cussed almost exclusively whether we can accept the state of 'brain death' as the criterion for the death of a person. In other words, the committee from the outset considered organ transplantation as an accepted modality of med- ical treatment, and made hardly any effort to contemplate on whether this premise is indeed tenable. After such a grossly insufficient discussion, the committee submitted a report in early 1992 stating that a majority of the com- mittee members accepted the state of 'brain death' as a criterion for human death, although a minority opinion negating this conclusion was attached. Then in 1994, the *Bill of Organ Transplantation* was introduced to the Japan- ese Diet by a group of legislators. Until its final passage and enforcement in late 1997, the discussion in the Health and Welfare Committee as well as gen- eral assembly of the Diet was centered on technical aspects of 'brain death', and the question on the appropriateness of organ transplantation was again completely set aside.

During the seven years after the enforcement of the *Law of Organ Trans- plantation* (hereafter abbreviated as the Law), multi-organ transplantation from brain-dead donors has been carried out in approximately thirty cases. Although this number was probably far less than what most protagonists (in- cluding transplant surgeons, certain patient groups and the Ministry of

Health and Welfare) would have hopefully anticipated, survey of those few cases revealed many serious problems, which clearly substantiate the validi- ty of our concern for and warning against the practice of organ transplanta- tion from the 'brain-dead' individuals.

Thus, in this article, I would like to (1) summarize the controversies on 'brain death' in Japan in recent years, (2) review some of the cases of multi- organ transplantation from brain-dead persons carried out in the last seven years to illustrate grave violation of human rights under the name of law, and

(3) present the reason why we should not diagnose human death at the state of so-called 'brain death' and should not authorize the removal of organs and tissues for transplantation at that stage.

I. *Controversies on Brain Death in Japan in Recent Years*

In the chapter *Brain death and cardiac transplantation: Historical back- ground and unsettled controversies in Japan* which I contributed to the an- thology *Beyond Brain Death. The Case Against Brain-based Criteria for Hu- man Death*,[1] I briefly reviewed the history of cardiac transplantation in Japan. I further pointed out the fact that today's mass media as well as the Japanese Government generally took the protagonist stand, and failed to supply to the public a well balanced information on the merits and disadvantages of organ transplantation from so-called 'brain dead' individuals. Rather, they only ad- vertise that organ transplantation is an accepted modality of treatment uti- lizing the most advanced medical technology and that donation of organs is a noble deed based on humanity and neighborly love. As a result, most lay people were made to believe that organ transplantation is a wonderful ther- apy that can save lives of patients suffering from otherwise incurable, hope- less illness.

Contrariwise, we antagonists stress the fact that to remove vital organs such as the heart from the so-called 'brain dead' donors (which actually is a murder) and utilize them to prolong the life of another person would lead to sorting out and discrimination of lives. Our concern that due to the shortage of donated organs, transplant proponents may try to expand the category of

[1] Y. Watanabe, *Brain death and cardiac transplantation: Historical background and unsettled controversies in Japan*, in *Beyond Brain Death. The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges, Dordorecht, Kluwer Academic Publishers, 2000, p. 171-190.

donors from 'brain death' to human vegetables, mentally handicapped peo- ple, and other weak members of the society. Utilization of anencephalic ba- bies as donors already being practiced in certain countries attests to the va- lidity of such a concern. Furthermore, lack of sufficient donors would in- evitably make the potential recipients look for an early death of someone hav- ing good histocompatibility with them, which is a most egotistic desire. Once we take such an egotistic desire for granted, morality of people indispensable for the maintenance of a sound society would be seriously damaged and we will end up with a society full of fear and unrest. Although transplant propo- nents tend to deny the possibility of nurturing such an egotistic desire, some recipients have honestly admitted that they sometimes had that feeling. We would highly value the good will of donors, but unfortunately their good will does not end up as a good will, and often promotes man's egotism. These neg- ative ethical, social and cultural implications of organ transplantation are so grave and far more deleterious for human society as compared to the superfi- cial benefit of transiently saving a small number of recipients. However, trans- plant proponents paid hardly any attention to those serious problems. For in- stance, most Japanese people today would still be reluctant to accept the death of their brain-dead family member with warm body and rosy skin, and this trend must have played a major role in restricting the number of donors to on- ly about thirty in the past seven years. While we think this is a natural response of ordinary people with a normal sense of life, transplant protagonists always blame such an attitude as purely emotional. They have, however, failed to pre- sent an effective rebuttal against our argument that acceptance of a loved one's death only when his (her) body turns ghastly pale and cold due to cardiores- piratory arrest (which is evident even to the lay people) is to retain the culture of mankind and not a mere sentiment. Although some proponents insist that the state of 'brain death' makes us predict imminent death of a person (im- plying they know the person is still alive), they want to remove and utilize that person's fresh vital organs at this stage and refuse to wait until the person's death is finally confirmed. Thus, it is evident that what they want is just fresh organs for transplantation, without being concerned with the donor candi- date's life as well as stability and safety of the human society.

It is truly unfortunate that the Government and mass media always take a protagonist stand and do not provide enough opportunities for an open de- bate between the protagonists and antagonists. To illustrate this point, I will quote the following anecdote. In the year 2000, Ohmoto, a Shinto religeous sect, carried out a nation-wide signature collecting campaign against the *Law*

of Organ Transplantation. They collected a total of more than 870,000 signa- tures, and submitted it to the Ministry of Health and Welfare in the fall. Even though I do not belong to that religious sect, I was asked to accompany their representatives in the submission of those signatures because of my well-known antagonist stand. At the office of the Ministry, many journalists and reporters were present, including a TV reporter from the NHK who asked some ques- tions to me and we exchanged name cards. When I watched the NHK news that night to find out how they would cover this event, the news did not men- tion anything about the submission of those signatures. Instead, they telecast- ed the story of a young couple whose baby was suffering from a severe heart disease requiring cardiac transplantation. Since the possession of a donor card showing the cardholder's free will to donate his organs when he became brain- dead is a prerequisite for the process of organ donation, and any one younger than 16 cannot hold such cards, the young couple would have to consider tak- ing their baby to the U.S. to find a child donor. The NHK thus stressed the need for a revision of the Law so that the family members' consent alone would be sufficient without the brain-dead person's free will to donate organs. I was really upset by such a news coverage because of the following reasons.

Although I can sympathize with the young parents who desperately want to save their baby, still it is no more than a family's ego. Contrariwise, submis- sion of the signatures of 870,000 people who were truly concerned with the future of mankind in general and soundness of the Japanese society in partic- ular should receive a far greater public attention than one family's ego. This event was sufficient to convince me that the NHK could not be considered a public broadcasting organization as they always claim. Similar examples can be found routinely in many other areas, and I must conclude that Japanese public has never been fully informed of numerous negative aspects of organ transplantation from brain-dead individuals. Even though transplant protag- onists often claim that more than 50% of Japanese people are now approving the state of 'brain death' as the criterion for a person's death, dissemination of such biased information must have played an important role in affecting the results of opinion polls. This argument can be clearly substantiated by my ear- lier survey carried out in 1994 on medical freshmen of Fujita Health Univer- sity and student nurses of Toyota Regional School of Nursing.[2] Before the stu- dents listened to my lectures pointing out numerous problems and risks of

[2] Y. Watanabe, *Further debate is needed on the problem of brain death and organ transplanta- tion* (in Japanese), in "Japanese Medical Journal," n. 3806, April 5, 1997, p. 73-76.

transplantation from brain-dead people, 32.4% of them (891275) accepted 'brain death' as a person's death and approved removal of organs in that state, whereas 17.5% (481275) were opposed and the remaining 50.1% undecided. After they were informed more fully by my lectures, 49.5% (136/275) now voted against and only 19.3% (53/275) for the *Bill of Organ Transplantation*. I must add the fact that, although numerous books have been published in Japan in the last ten years criticizing the concept of 'brain death' and organ transplantation,[3] essentially no opportunities have been provided for an open debate between protagonists and antagonists so that the public can make a better judgment on this problem. A rather rare example was the debate be- tween two proponent cardiologists and myself, which was triggered by my ar- ticle in the "Japanese Heart Journal."[4] However, as all the papers were pub- lished in this cardiology journal in English, the debate was not noticed by the public. Furthermore, when I wrote a rebuttal pointing out numerous flaws in their logic, the proponents never responded to my criticisms.

II. *Our Seven Year Experience After the Enforcement of the Organ Transplantation Law*

As has been briefly discussed in the addendum to my earlier article,[5] multiple organ retrieval from a middle-aged female with subarachnoid (and cere-

[3] *'Brain Death''and Organ Tansplantation* (in Japanese), edited by T. Umehara, Tokyo, Asahi Newspaper Co., 1992; Why is Organ Transplantation From Brain Dead People Dangerous? (in Japanese), edited by Y. Watanabe, T. Abe, Tokyo, Yumil Publishing Co., 1994; *Is Organ Trans- plantation A Sign of Love?* (in Japanese), edited by Committee on Brain Death and Organ Trans- plantation, Tokyo, Hyoron-sha, 1997; *We Object Against Brain Death and Organ Transplantation* (in Japanese), edited under supervision by Y. Watanabe, Kameoka, Tensei-sha, 1999; K. Ikeda, *Or- gan Transplantation: I Would Not Do and Would Not Let Others Do* (in Japanese), Tokyo, Shogakkan, 2000; M. Kondo, M. Nakano, T. Miyazaki, et al., *I Do Not Donate Organs* (in Japan- ese), Tokyo, Yosensha, 2000; K. Yamaguchi, Y. Kuwayama, *Brain Death and Organ Transplanta- tion. Declaration of Refusal* (in Japanese), Tokyo, Shufu-no-Tomo-sha, 2000.

[4] Y. Watanabe, *Why do I stand against the movement for cardiac transplantation in Japan?*, in "Japanese Heart Journal," 35, 1994, p. 701-714; H. Toshima, C. Kawai, *Why is heart tansplantation not performed in Japan? Refutation of Dr. Yoshio Watanabe's arguments against heart transplantation*, in "Japanese Heart Journal," 36, 1995, p. 13-21; Y. Watanabe, *Once again on cardiac transplanta tion. Flaws in the logic of the proponents*, in "Japanese Heart Journal," 38, 1997, p. 617-624.

[5] Y. Watanabe, *Brain death and cardiac transplantation: Historical background and unsettled controversies in Japan*, in *Beyond Brain Death. The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges.

bral?) hemorrhage carried out in February 1999 was the first case after the enforcement of the Law. In this case, the physicians of Kochi Red Cross Hos- pital appeared to have looked at the patient as a donor candidate from the outset because of her possession of a donor card. Thus, instead of adminis- tering certain life saving measures including lowering of her extremely high blood pressure, they immediately told the family that she was in the state of "impending 'brain death'," and did not mention the possibility of surgical re- moval of the huge intracranial hematoma that might have saved her life. Fur- thermore, although the Law clearly states that an apnea test must be done as the last of the set of diagnostic procedures, this test was repeated several times, some even before the electroencephalogram became flat. Such tests must have accelerated the progression of 'brain death' and at the same time inflicted intolerable pain to the patient. Finally on skin incision for the re- trieval of organs, the patient's blood pressure suddenly rose and her extrem- ities showed excessive movements requiring anesthesia. These phenomena strongly suggest that she felt the pain and her brain stem was functioning, clear signs negating the state of 'brain death'.

The third case was a young man involved in an automobile accident. He was brought to the Emergency Department of Furukawa Municipal Hospi- tal one evening, where he was found to have a donor card. When the chief of neurosurgery then at his home was notified of this case two and a half hours later, he told his stuff just to observe the course saying that there would be no indication for surgical intervention. He did not come to the hospital un- til four hours later, and no intensive therapy was given for more than ten hours to prevent the progression of brain damage such as administration of drugs to lower intracranial pressure. Thus, here again the accident victim was not regarded as a person who needs urgent life saving measures, and instead was treated only as a donor candidate. These and other similar examples clearly illustrate the general trend of today's emergency care team to dis- criminate against potential organ donors, utilizing an excuse to save the life of some recipients. Against these gross violations of human rights, several lawsuits have been filed by local bar associations.

However, transplant protagonists simply ignore such obviously negative aspects of the present *Law of Organ Transplantation*, and are now trying to alter the Law so that possession of a signed donor card certifying a person's free will to donate his (her) organs at the stage of 'brain death' would not be required and the family's consent alone would be sufficient. This movement is intended to increase the number of donors and alleviate the shortage of or-

gans. When we recall the fact that stipulation of the requirement of such a donor card played a crucial role in the final passage of the *Bill of Organ Trans- plantation* in 1997, this new campaign represents a most serious, dangerous movement to force the generally discreet present day Japanese society to ful- ly accept the modern medical technology and give up the traditional man's wisdom. Many groups of citizens are trying to stop such a movement. Thus, controversies on 'brain death' still continues in Japan despite unfavorable, bi- ased information control, and our seven year experience under the present Law definitely warns us not to stop the effort to fight against the protagonists' further assault to the soundness of society and culture of mankind.

III. *Why We Should Not Accept the State of Brain Death As the Criterion For Human Death*

In my earlier article,[6] I discussed in detail why we should not accept the state of 'brain death' as the criterion for human death, criticizing and refut- ing each of the protagonists' arguments for 'brain death'. Briefly summarized, the state of 'brain death' at best represents "prediction of imminent death of a person" and definitely not "confirmation of death," and even protagonists themselves admit this fact. Here, it must be pointed out that, once a 'confir- mation of death' principle gives way to the 'prediction of death' principle, the line separating life and death becomes too fuzzy, since every human being is destined to die and death can be predicted from the moment of birth. Al- though protagonists may try to avoid this criticism by attaching the adjective imminent, the word imminent is again too vague and often does not apply since the state of 'brain death' could often last for weeks to months and even one case living for twenty years has been reported.[7]

I further quoted the remarkable efficacy of brain hypothermia therapy in saving patients with severe brain damage and preventing the occurrence of 'brain death'. This therapy was developed by the Emergency Care Depart- ment of Nihon University Hospital in Tokyo.[8] In their first report, this ther- apy was applied to 20 cases of acute subdural hematoma with diffuse brain

[6] Id.

[7] D.A. Shewmon, *Recovery from 'Brain Death': A Neurologist's Apologia*, in "Linacre Quar terly," 64, 1997, p. 30-96.

[8] N. Hayashi, *Brain hypothermia therapy* (in Japanese), in "Japanese Medical Journal," n. 3767, July 6, 1996, p. 21-27.

injury and 12 cases of global cerebral ischemia due to cardiac arrest lasting for 30-47 minutes, all of them showing Glasgow coma scale of 3 to 4, bilat- eral dilatation of pupils and loss of light reflex. With computer controlled brain hypothermia and maintenance of adequate intracranial pressure, 14 of the 20 patients in the first and 6 of the 12 patients in the second group re- turned to normal daily life, with their verbal communication restored except for one patient. Although 'brain death' proponents may well argue that, since the emergency care physicians did not apply apnea test in fear of aggravating brain damage, those 32 cases might not have been in the state of 'brain death', such a remarkable success of this therapy implies a clear shift of the point of no return toward or into the stage of brain death.[9] Studies by Coimbra on an- imals sustaining severe head trauma clearly presents an experimental evi- dence supporting the remarkable clinical efficacy of brain hypothermia treat- ment. He showed that lowering of body temperature to 330C in those ani- mals decreased brain edema and lowered intracranial pressure, thus increas- ing cerebral blood flow above the critical leve1.[10] This effect, together with prevention of the development of brain hyperthermia that accelerates nerve cell damage, was able to restore normal brain function, whereas an apnea test carried out in such animals caused severe hypotension and further reduced cerebral blood flow, destroying the entire brain. Hence, the state of 'brain death' in the sense of truly irreversible damage of the brain can be diagnosed only after the application of brain hypothermia therapy, and an apnea test should be immediately deleted from the set of diagnostic procedures listed in the present *Law of Organ Transplantation*.

Now, I would like to herein present my final argument against the brain based criterion for the death of a person. The word death, an antonym of life, obviously implies termination of the life phenomena. In turn, the word life phenomena should apply to all living organisms including not only human being and other members of the animal kingdom, but also to all species of the plant kingdom. I assume that even those people supporting the concept of 'brain death' and advocating transplantation of organs from the brain- dead donors would not tell us that the green trees, grasses and algae on which

[19] N. Hayashi, *Brain hypothermia therapy*; K. Yamaguchi, *Brain hypothermia treatment: Re- suscitation from impending brain death* (in Japanese), in *Is Organ Transplantation An Expression of Love?*, edited by Committee on Brain Death and Organ Transplantation, p. 29-34.

[10] C.G. Coimbra, *Implications of ischemic penumbra for the diagnosis of brain death*, in "Brazil- ian Journal of Medicine and Biological Research," 32, 12, 1999, p. 1479-1487 (http://www.sci-elo.br/pdf/bjmbr/v32n12/3633m.pdf).

human and animal life is dependent are not living since plants do not possess brains. If this assumption of mine is correct, those protagonists must realize that there is a crucial flaw in their logic accepting 'brain death' as the criteri- on for death. Indeed, plants show all aspects of life phenomena in common with animals, including energy metabolism, maintenance of a stable internal environment as an individual, growth and reproduction. Therefore, presence or absence of normal brain function alone cannot and should not separate life and death of a living organism.

Contrariwise, it can be said that cessation of energy metabolism and dis- ruption of the stable internal environment as an individual could well signi- fy death in animals and plants alike. In man and other mammalian as well as avian species, irreversible cardiorespiratory arrest readily brings about such a condition. Cessation of circulation of bodily fluid in lower animals and that of sap in trees might correspond to cardipulmonary arrest in higher animals in causing termination of energy metabolism and disruption of stable inter- nal environment. The traditional criteria for the death of a person, or com- bination of irreversible cardiorespiratory arrest and the loss of light reflex that signify cessation of normal function of the three vital organs (the heart, lungs and brain), would not only be far more accurate than the brain-based criterion, but also provide the family members sufficient time to care the dy- ing person to the very end and to emotionally prepare for the sad event of a loved one's departure from this world.

It is quite possible that proponents of the 'brain death' criterion still try to argue against this logic. For instance, they might say that man has the most highly developed brain system that enabled us to speak, write, think meta- physically, develop art, science, religion and what is called civilizations, and since none of such abilities are shared by any other living organisms, man has a special place in the universe and the criteria for human death can be or should be different from those for other forms of life. If they really resort to such an argument, I would like to call their attention to the point I made in my earlier article[11] quoting one of the categorical statements of Kant. The statement says that a man should always treat another man as an object, and should never use another man only as means. Such categorical statements are considered to hold true unconditionally beyond time and place, and the fact

[11] Y. Watanabe, *Brain death and cardiac transplantation: Historical background and unsettled controversies in Japan*, in *Beyond Brain Death. The Case Against Brain Based Criteria for Human Death*, edited by M. Potts, P.A. Byrne, R.G. Nilges.

we value these statements is what separates human beings from other ani- mals. Since organ transplantation exactly utilizes another man just as means, it is definitely an act against these statements defining what separates human beings from other living organisms. Thus, all transplant protagonists are ac- tually giving up to be human beings, quid hence, they should not argue that man occupies a special place in all the living organisms and has the right to claim for a special criteria for their death. For these reasons, the brain based criterion for human death advocated mainly for the purpose of organ trans- plantation would have no theoretical background as long as we want to re- main as human beings.

Conclusions

I have reviewed the recent state of continuing controversies on 'brain death' in Japan where information control to push organ transplantation pre- vails with anew movement to delete the requirement for a signed donor card. Our seven year experience after the enforcement of the present Organ Trans- plantation Law reveals numerous examples of grave violation of human rights, substantiating our concern for the negative influence of organ trans- plantation from brain dead people on the society and man's culture. Finally, I pointed out that the criteria for death must be applicable to all the living or- ganisms including man, animals and plants, and presented the reason why we should not accept the state of 'brain death' as a valid criterion for human death.

For more detailed arguments against 'brain death' and organ transplan- tation not covered here, please refer to the papers cited in my previous arti- cle[12] and several more recent publications.[13]

[13] T. Shimizu, *Euthanasia, dignitary death and brain death-organ transplantation. Trickery of fabricated death* (in Japanese), in "Consumer Report," n. 1126-1135, August - December 2000; B. Matsumoto, *Consideration on 'brain death' and transplantation. Disparity between the sense of bed- side medicine and bioethics* (in Japanese), in Toward the Regeneration of Bioethics, edited by West Japan Research Group on Bioethics, Tokyo, Seikyu-sha, 2004, p. 278-312; K. Morita, *What is be- tween 100% and 0% of brain death misdiagnosis ratio (in Japanese)*, in "Sekai," December 2004,
p. 62-70.

The Concept of Brain Death and the Death of Man

RALPH WEBER

I. *Problem Definition*

In 1849, Friedrich Carl von Savigny could say "Death as the end of the nat- ural enjoyment of civil rights is such a simple natural phenomenon that it does not make a more exact observation of its elements necessary as does birth"[2] without being criticized. Today, this has dramatically changed. What seemed to be a natural phenomenon, something "given and not to be interpreted"[3] by legal doctrine, has become something in need of further definition. Along with this, we have had to escape from the illusion of being able to understand from nature itself whether this definition is right or wrong. "What seemed to be a natural fact outside the scope of human responsibility now becomes a decision for which responsibility must be taken on."[4] And where the limit should be drawn in the individual case no longer depends only on natural facts, but in- creasingly on the technical state of medical science on the one hand and a moral decision on the other.[5] Already Karl Jaspers and Martin Heidegger rec- ognized the concept of death "as an enormous problem for our society… not only, because it directly threatens the continuity of human relations, but indi- rectly also threatens the basic ideas of order on which our society is based."[6]

[1] X. Bichat, *Recherches physiologiques sur la vie et la mort*, Paris 1796.
[2] F. C. von Savigny, *System des heutigen römischen Rechts*, Bd.II, 1840, § 63 p. 17.
[3] Jacoby, *Allgemeine Ontologie der Wirklichkeit*, Bd. 1, 1925, p. 21.
[4] Bayertz, *Ethik, Tod und Technik*, in *Hirntod und Organverpflanzung: ethische, medizinische, psychologische und rechtliche Aspekte der Transplantationsmedizin*, edited by J.S. Ach and M. Quante, Stuttgart, Frommann-Holzboog, 1997, p. 75ff. (84).
[5] Ibid., p. 85, fn. 4.

Our fear of death" becomes amplified and scepticism arises, if a further sign of death is introduced "in addition to the one known from time immemorial,"
i.e. the classic heart circulation failure.[7] This further sign is the cessation of all brain currents[8] which is "externally so inconspicuous that it must be ascer- tained by a special medical examination and … exclusively occurs under in- tensive medical care conditions."[9] The brain-dead patient does not show clas- sic death signs such as the decrease of body temperature, post-mortem lividi- ty, rigor mortis and decomposition; he shows no external characteristics of death and "by definition cannot develop any."[10]
Ultimately, nobody knows the exact boundary between life and death, and the 'brain death' criterion does not undo this ignorance. Consequently, "Der Spiegel" describes so-called 'brain-dead' patients as "hybrid beings in the limes area between life and death."[11] Rarely have discussions been led by all sorts of scientific disciplines[12] with such passion like as the justification of the 'brain death' criterion.[13] It deals with "no more and no less than the cen- tral points surrounding the modern notion of death, i.e. illness, suffering, healing, personhood and society ideal; and it deals with all of this in the spe- cific death imagery of 'brain death.'[14] In any case, the entire 'brain death' de- bate clearly shows that social consensus on the exact time of death has been "deeply shaken."[15] This contribution is directed at all persons who wish to deepen their understanding of the concept of death.

[6] Cited according to Berger, *Zur Dialektik von Religion und Gesellschaft*, 1973, p. 24.
[7] The so-called cardio-respiratory standard.
[8] The so-called neurological standard.
[9] Angstwurm, *Wann ist ein Mensch wirklich tot?*, in *Gehirntod und Organtransplantation als Anfrage an unser Menschenbild*, 1995, p. 33ff. (34).
[10] Patzelt, *Die Hirntodproblematik aus rechtsmedizinisch-biologischer Sicht*, in *Hirntod und Or- gantransplantation*, edited by Höglinger and Kleinert, 1998, p. 20.
[11] Spiegel 1997, issue 10.
[12] H. Jonas, *Against the Stream Comments on the Definition and Redefinition of Death*, in *Philosophical Essays: From Ancient Creed to Technological Man*, Englewood Cliffs, N.J., Prentice Hall, 1974, 132ff. and ibid., in *Technik, Medizin, Ethik*, (3. Aufl. 1990) p. 219ff. (233). See also *Wissenschaftler für ein verfassungsgemäßes Transplantationsgesetz*, Bt-Gesundheitsausschuss, Ausschussdr. 13/117 p. 3ff.
[13] Rixen thoroughly describes the state of affairs until the end of 1997 in Rixen, *Lebensschutz am Lebensende*, (1998), passim.
[14] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, (1999), p. 160.
[15] Sociological assessment in the state doctoral thesis of Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrittenen Moderne*, p. 188.

At its core, this is all about the question of whether or not the concept of death describes a biological fact or whether we form a legal artificial con- cept of death according to utilitarian considerations, thus allowing a "so- cial reconstruction of death"[16] and are thus becoming forerunners in "defining-man-to-death,"[17] for the way we deal with death and dying is an original expression of our culture.[18] If a putative large-scale societal inter- est against the right to undisturbed individual death prevails, "the danger exists that the technical imperative of ensuring survival will win over basic moral values and nothing will stand in the way of unimpeded organ har- vesting."[19] In other words, "our entire moral notion of man might be com- promised by an enforcement of an interest-oriented determination of death."[20]

II. *The Fact of 'Brain Death'*

1. *The Concept of 'Brain Death'*

The core issue in this debate is the concept of 'brain death'. This con- cept accepted[21] by the majority[22] of medical experts,[23] is supported by the

[16] Ibid., p. 8.
[17] Terminology from Klinge, *Todesbegriff, Totenschutz und Verfassung* (1996), p. 133.
[18] See, for example, the discussion in Japan, where the concept of brain death and transplan tation have been strongly opposed. For more information: Feldmann, *Brain death: the Japanese Controversy*, in *Brain Death* edited by C. Machado, 1996, p. 265-284 sowie Lock, *The Unnatural as Ideology - Contesting Brain Death in Japan*, in *Japanese Images of Nature*, edited by Asquith and Kalland, 1997, p. 121-144.
[19] Weber, *Der soziale Tod* (1994), p. 328.
[20] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, p. 50.
[21] Bayertz, *Ethik, Tod und Technik*, in *Hirntod und Organverpflanzung*, p. 75 speaks of "world wide acknowledgment."
[22] For information on the critical minority of doctors compare the initiative *Wissenschaftler für ein verfassungsgemäßes Transplantationsgesetz*, in *Die Schwester/Der Pfleger*, issue 11, 1995, p. 1095, and the official letter of *Ärzte für das Leben e.V.* directed at the president of the Bun- desärztekammer, printed in *Ärzte für das Leben - Presseinformation vom 17.07.1995*.
[23] Among many others: Schlake, Roosen, *Der Hirntod als der Tod des Menschen*, 1995; Spit- tler, *Der Hirntod*, in "Ethik in der Medizin," 1995, 128 (135ff). und *ders*., *Sterbeprozess und Todeszeitpunkt*, 1996 sowie die zahlreichen Nachweise bei Rixen, *Lebensschutz am Lebensende*, p. 188-207.

churches,[24] approved theologically,[25] and philosophically,[26] widely spread also in jurisprudential literature[27] and also serves as a foundation for Ger- man transplant law with regard to donor organs[28] by way of the dynamic reference in §§ 3 II, no. 2, and 16 I 1, no. 1, *Transplantationsgesetz*.[29] Ac- cording to this concept, the irreversible failure of all cerebral, midbrain and brainstem functions[30] with otherwise sustained cardiovascular function[31] under intensive care conditions is thought to be a reliable criterion for the occurrence of death.[32] At the base of this lies an oedema of the brain through which the pressure inside the skull exceeds the mean arterial blood

[24] Declaration of the German Bishops Conference and the Council of Evangelical Churches in Germany, 1990: "Brain death is the death of the human being just like cardiovascular death is."

[25] Furger, *Probleme der Transplantationsmedizin aus theologischer Sicht*, in *Hirntod und Or- ganverpflanzung*, edited by J.S. Ach and M. Quante, p. 101 ff.; Körtner, *Bedenken, dass wir ster- ben müssen*, 1996; Lang, *Kultur des Lebens oder Kultur des Sterbens*, in "ZRP," 1995, p. 457; Rosen- boom, *Ist der irreversible Hirnausfall der Tod des Menschen?*, Frankfurt a.M., Peter Lang, 2000 and Thielicke, *Fortschritte der Medizin*, 1968, p. 1066ff. See opposing statements of Pope Pius XII: "Mais des considérations d`ordre général permittent de croire que la vie humaine continue aussi longtemps que ses fonctions vitales - a mème … l`aide de procédés artificiels," in the French orig inal in the "Acta Apostolicae Sedis," 49, 1957, p. 1027ff.

[26] Birnbacher, *Hirntodkriterium, Anthropologisch-ethische Aspekte*, in "MedR," 1994, 467 (469ff)., and *Fünf Bedingungen für ein akzeptables Todeskriterium*, in *Hirntod und Organ- verpflanzung*, edited by Ach and Quante, p. 49ff.

[27] Eser, *Medizin und Strafrecht*, in "ZStW," 92, 1985, p. 1ff. (27ff).; Heun, *Der Hirntod als Kri- terium des Todes des Menschen*, in "JZ," 1996, p. 213 (218f).; Klinge, *Todesbegriff, Totenschutz und Verfassung*, p. 144ff.; Laufs, *Arztrecht*, (5. Aufl). Rn. 277; Seewald, *Ein Organtransplantationsge- setz im pluralistischen Verfassungsstaat*, in "VerwArch," 1997, p. 199 (p. 210); Uhlenbruck, in *Handbuch des Arztrechts*, edited by Laufs/Uhlenbruck, (seit 1. Aufl. 1992), 142 Rn. 4, je m.w.N. sowie die umfangreichen Nachweise bei Rixen, *Lebensschutz am Lebensende*, especially p. 92-98 penal law and p. 108-124 for constitutional law.

[28] According to § 9 *Transplantationsgesetz* this includes the kidney (first transplantation by J. Murray, 1954), heart (first transplantation 1967 by Ch. Barnard), liver, lung, pancreas, small in testine.

[29] *Transplantationsgesetz* [*Transplantation Law*] was passed by the Deutscher Bundestag on June 25th, 1997, with a 2/3 majority vote. Bavastro, *Das Hirnversagen und das Transplantationsge- setz*, in "ZRP," 1999, p. 114 (p. 116).

[30] Spittler, *Der Hirntod*, p. 128 (p. 136).

[31] Brain death criteria of the Scientific Board of the Federal Chamber of Physicians, printed in "Deutsches Ärzteblatt" (DÄBl) 1982, 45f. and more recently in DÄBl, 1991, 2855ff.; 1993, 2177; 1996, 2940f.

[32] Interestingly, this criterion of death was normatively introduced in 1968 by the ad-hoc-com mittee of Harvard Medical School, seven months after the first heart transplantation. This ap peared to suggest that man can survive his own cardiovascular death, and the heart can survive in dividual death (Geilen, *Medizinischer Fortschritt und juristischer Todesbegriff*, in *Festschrift für Heinitz*, 1972, 373ff. [p. 373]).

pressure. As a consequence, the brain circulation ceases, massive neuronal death ensues leading to the progressive dissolution of brain necrosis despite the fact that bodily circulation continues.[33] The relevance of this partial or- gan death is explained by the special 'role' of the brain as the "decisive in- tegrating organ of an independent totality."[34] In the case of an intended or- gan removal, this condition must be independently certified by two quali- fied doctors who may be involved in neither the organ removal nor its as- signment and are not bound by the instructions of a third doctor involved in either process. The occurrence of death is either determined or defined, depending on the standpoint, by a flat line in the EEG or a certain period of observation.[35] The latter is age dependent. Death becomes "isoelectrical silence"![36]

But despite this legal consensus, the discussion surrounding the justifica- tion of the concept of 'brain death' has not ceased, on the one hand because "Caesar non supra scientiam," as the Romans well knew, and, more impor- tantly, because the legislative majority's opinion has not scientifically con- fronted the counter-arguments of the minority application,[37] but rather they simply left it unconsidered. Tröndle puts it this way*:* "The legislator may as- sume to have served the belief in progress of transplant medicine in a rea- sonable way, but he has not served truth."[38]

2. *The Difficulty of Evidence*

With regard to the required specification of the conditions of this 'brain death' criterion, this seems to be a sufficient guarantee to the Scientific Board of the Federal Chamber of Physicians.[39] It must be put on record that in the face of this truly existential question on life or death, in this border zone with undoubtedly smooth transitions, machine-aided determination of the flat

[33] Some refer to brain death as an 'internal decapitation'.

[34] Klinge, *Todesbegriff, Totenschutz und Verfassung,* p. 141ff.

[35] Scientific Board of the Federal Chamber of Physicians, *Kriterien des Hirntodes - Dritte Fortschreibung 1997,* C-959 (zu den unterschiedlich lagen Beobachtungszeiten unter sub 3.1 und 4).

[36] Schlake, Roosen, *Der Hirntod als der Tod des Menschen* (o.J.), illustration Nr. 17 p. 37 and 41.

[37] E. v. Kleaden u.a., vgl. BT-Drs. 13/6391

[38] Tröndle, *Der Hirntod, seine rechtliche Bedeutung und das neue Transplantationsgesetz,* in *Festschrift für H.J. Hirsch*, 1999, p. 779ff. (p. 786).

[39] Dencker, *Zum Erfolg der Tötungsdelikte*, in "NStZ," 1992, 311ff.; Joerden, *Tod schon beim 'alsbaldigem' Eintritt des Hirntodes?*, in "NStZ," 1993, 268ff.

EEG is not obligatory[40] for the determination of 'brain death'. Rather, merely age-dependent observation times suffice.[41] The questions regarding the reliability of such observations, but also the relatively elaborate procedures of clinical diagnosis methods that are used to show that the brain's activity has irreversibly ceased, raise an empirical problem. This problem doesn't primarily concern the jurist, but the neurologist.[42] In addition, it is worth pointing out that even physicians publicly declare that 'brain death', un- derstood as the complete cessation of all brain function, cannot be ful- filled.[43] In any case, the co-existence of coma, apnoea, areflexia of the brain- stem and a flat EEG cannot prove the failure of all brain function.[44] On the contrary, scientific results point to the fact that some brain functions still ex- ist in brain-dead patients.[45] Parts of the hypothalamic-pituitary axis as well as parts of the temporal cortex, the Thalamus and the brainstem might all still have residual function.[46] Let it suffice that these compelling facts be mentioned, at this point, instead of elaborating this medical, neurological controversy any further.

3. *The Concept of Death and 'Absolute Truth'?*

At least one fact remains striking. Although we all know and agree that ultimately nobody knows the exact boundary between life and death, the concept of 'brain death' aims at "constructing the picture of a positivist sci- ence of death in a virtually naive way" so as if one were able to present 'ab- solute truths'. This manifest attempt to not only ignore all criticism, to de- mote counter-arguments as insignificant, and also to sustain the ongoing con- sensus regarding the concept of brain death,[47] "occasionally using argument

[40] Probst, *Hirntod - Tod des Menschen?*, in *Medizin und Ideologie*, Juni 1999, p. 6ff.
[41] Oduncu, *Der 'Hirntod' als Todeskriterium - biologisch-medizinische Fakten, anthropolo- gisch-ethische Fragen*, in "Medizinstrafrecht," 2001, p. 199ff. (208ff).
[42] Birnbacher, *Fünf Bedingungen für ein akzeptables Todeskriterium*, p. 51f.
[43] Klein, *Hirntod: Vollständiger und irreversibler Verlust aller Gehirnfunktionen?*, in "Ethik in der Medizin," 7, 1995, p. 6-15.
[44] Id.
[45] Geisler, *Ärztliche Sicht des Hirntodes*, in *Die Seele verpflanzen? - Organtransplantation als psychische und ethische Herausforderung*, edited by Herrmann, 1996, p. 80ff.
[46] Schadt, *Der Hirntod - Tod des Menschen?*, 1995, p. 9 refers to Klein, *Hirntod: Vollständiger und irreversibler Verlust aller Gehirnfunktionen?*
[47] Merkel, *Hirntod und kein Ende*, in "Jura," 1999, p. 113ff. (113f. and 116f).

with strange structure"[48] shows an understanding of science that has been "led *ad adsurdum* by the principle of falsification of critical rationalism. This principle especially binds the natural sciences."[49] In the debate around 'brain death', the opposite way was chosen. First, a goal was defined, and then any- thing that stood in the way of achieving it was blinded out as insignificant.[50]

III. *Central Points of Criticism*

1. *Diverging from the Biological Concept of Death*

According to usual language usage, 'life' describes a scientifically experi- enceable biological status.[51] The advocates of the concept of 'brain death' ob- viously attempt at holding on to a natural, i.e. biological concept of death in order to clarify that the human physiology of death does not differ from that of other living beings. They do not want to get rid of "fundamental biologi- cal fact of human life"[52] with this new death criterion. The Scientific Board of the Federal Chamber of Physicians has always correspondingly empha- sized that "there has always been and there still is only one death of man,"[53] even after acknowledging the concept of 'brain death'. 'Brain death' is to be understood only as a new criterion of death, and thus avoiding the formula- tion of a new definition of death, a so-called "social concept of death."[54] For "denaturalizing the fact of death"[55] could too easily lead to an object of ne- gotiation, open to considerations of practicability. And in this point there is hopefully still agreement: Practicability and consensus alone are not ade- quate conditions for the creating or justifying of a new definition of death.[56]

[48] Rixen, *Lebensschutz am Lebensende*, p. 170.
[49] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, p. 193.
[50] Bavastro, *Das irreversible Hirnversagen: eine kritische Betrachtung zur Hirntod-Debatte*, in *Aneignung und Enteignung - der Zugriff der Bioethik auf Leben und Menschenwürde*, edited by Dörr, 2000, p. 101ff. (p. 101).
[51] Klinge, *Todesbegriff, Totenschutz und Verfassung*, p. 126.
[52] Geddert-Steinacher, *Menschenwürde als Verfassungsbegriff*, 1990, p. 61.
[53] Scientific Board of the Federal Chamber of Physicians, in "Deutsches Ärzteblatt," 1993 (Heft 44), p. B 2177-2179.
[54] Bayertz, *Ethik, Tod und Technik*, in *Hirntod und Organverpflanzung*, p. 86.
[55] Ibid., p. 83.
[56] M. Reuter, *Abschied von Sterben und Tod*, 2001, p. 36.

If ‘brain death’ were only a new criterion of death and not a new defin- ition of death,[57] this must mean that the “specific feature of human death” is determined neither biologically nor by its criteria, but alone by man’s knowledge of his death[58] and is otherwise biologically similar to the death of an earthworm. Death as the end-point of the biological life, not only of conscious experience, must remain a biological determinant, because there cannot be a third condition between life and death.[59] *Tertium non datur!*[60] A definition of death is not compatible with Art. 2. Par. 2 of the Constitu- tional Law, if it is not based on physical existence of man, but instead with- draws the right to life due to the lack of certain cognitive capacities. This means that the death of man occurs only with the loss of function of both essential systems, consciousness and the physical organism; the irreversible failure of only one of these systems does not suffice to speak of the occur- rence death. The liveliness of an organism is a result of the constant inter- action of the organ systems and is not produced only by the brain.[61] The equation of irreversible brain failure with the death of man, on the other hand, suggests that “the brain contributes something special to the (bio- logical) life in contrast to the other organs. This is not the case.”[62] “It is therefore not justifiable to say that the failure of central nervous system con- trol in particular is incompatible with life, whereas this is not the case for the failure or even the complete replacement of other vitally necessary or- gans (kidney dialysis, heart lung machine).”[63] Thus the insight “tres sunt

[57] J.P. Beckmann, *Hirntodkriterium und menschliche Autonomie aus philosophisch-ethischer Sicht*, in *Festschrift für Bemmann*, 1997, p. 18ff. (p. 21f.).

[58] M. Reuter, *Abschied von Sterben und Tod*, p. 135.

[59] Deshalb ist es mindestens missverständlich davon zu sprechen, an die Stelle des Problems der Scheintoten des 18. Jahrhunderts sei in diesem Jahrhundert das Problem der “Schein-Leben- den” getreten (so Hartmann, *Grenzen ärztlichen Vermögens am Lebensende*, in *Sterben und Tod in Europa*, edited by Becker, Feldmann, Johannsen, 1998, p. 37ff. [p. 49]); sowenig es einen Schein- toten gibt, kann es Scheinlebende geben - beide erfüllen vielmehr das biologische Signum des Lebens!

[60] Spittler, *Der Hirntod*, p. 3; J.P. Beckmann, *Hirntodkriterium und menschliche Autonomie aus philosophisch-ethischer Sicht*, p. 18ff. (20f.).

[61] Rixen, *Lebensschutz am Lebensende*, p. 304f.

[62] Roth, Dicke, *Das Hirnproblem aus der Sicht der Hirnforschung*, in *Wann ist der Mensch tot? Organverpflanzung und Hirntodkriterium*, edited by J. Hoff and J. in der Schmitten, Reinbeck bei Hamburg, Rowohlt, 1994, (erweiterte Neuauflage 1995), p. 51ff. (52f.).

[63] J. Hoff, J. in der Schmitten, *Kritik der ‘Hirntod’-Konzeption*, in *Wann ist der Mensch tot? Organverpflanzung und Hirntodkriterium*, edited by Hoff, in der Schmitten, p. 194.

atria mortis"[64] led back to the Roman doctor Galenus remains valid. This includes the failures of the heart, the lungs and the brain. Impossible or failed reanimation of the heart in the sense of "not being able to restart"circu- lation and the organism as a functional entity[65] can be diagnosed approximately after 15-30 minutes after the patient's terminal breath, according to current knowledge.[66] If one still adds a safe distance of a further 30 minutes, one can then say that the person in question is now dead biologically. In the absence of this, one describes a death that only people (perhaps still chimpanzees, dol- phins and the like) can experience. However, an earthworm without an intel- lectual existence cannot die a death by loss of its personal identity, and an irre- versibly unconscious patient in turn would have died such a death already.[67] If one sees this, then the parallel of the 'brain death' theory with biological death is revealed to be "suppressive rhetoric,"[68] a "*petitio principii* based on a categorical mistake."[69] It becomes a circular argument that commits the "epistemological mortal sin"[70] of confusing "the trivial but fundamental legal distinc- tion between is and ought."[71] It is false to equate the propositions "The 'brain death' criterion is a sign of death and not a redefinition of death" and "verified 'brain death' is a certain sign for the occurrence of man's death, but it is not the death of man although man is dead after the diagnosis of 'brain death'."[72] Is this the "rather simple message"[73] of the concept of 'brain death'?

In this respect, it is worth mentioning that the fathers of the concept of 'brain death', a commission of Harvard Medical School in 1968,[74] never use biological arguments for the necessity of a new definition of death.[75] More-

[64] Wagner, *Gemeinsamkeiten zwischen Hirntodkonzept und traditionellen Todesze- ichenkonzepten - Überlegungen zu den anthropologischen Grundlagen des menschlichen Todes*, in "Ethik in der Medizin," 1995, 193ff. (198ff.).

[65] Rixen, *Lebensschutz am Lebensende*, p. 347.

[66] Larsen, *Anästhesie*,... (4. Aufl. 1995), p. 963.

[67] M. Reuter, *Abschied von Sterben und Tod*, p. 150f.

[68] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, p. 195.

[69] Rixen, *Lebensschutz am Lebensende*, p. 240.

[70] Hilgendorf, *Moralphilosophie und juristisches Denken*, in "ARSP," 82, 1996, p. 399.

[71] Rixen, *Lebensschutz am Lebensende*, p. 242.

[72] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, p. 193.

[73] SPD-Delegate Dreßler in a debate of the Bundestag. BT-Drs. 13/183

[74] See original text in Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrittenen Moderne*, p. 162.

[75] *A Definition of Irreversible Coma. Report of the Ad Hoc Committee of the Harvard Medical*

over, the only reasons given are "the relief of patients, their families and the medical facilities" and the possibility "retrieving organs for the purpose of transplantation."[76] For only fresh organs that have not been exposed to pro- longed ischemic stress[77] can be used for transplantation.[78] It is highly du- bitable whether a "needs-based-argumentation" can suffice for the intro- duction of a new definition. This apparent means-to-an-end rationale behind the 'brain death' criterion is not proof of its falsity, but it shows that later at- tempts at justifying it must be rigorously questioned.[79] For drawing the line between life and death cannot be arbitrary and must lie without the contin- gency of both individual and collective authority.[80] This "historical indebt- edness"[81] was insistently exposed and denounced by Hans Jonas and never satisfactorily "cashed in."[82] On this background, the Federal Chamber of Physicians has emphasized repeatedly that even partial concepts of 'brain death' must "refer to the biological foundation of man in any attempt at de- termining, in an uncompromising way, whether a human being is alive or dead."[83] This remains true. However, only a combination of cardiovascular and central nervous failure may be regarded as this biological foundation.

Ultimately, life and death are not constructs of this world, i.e. human con- structs. Other than mere signs of death, the criterion of 'brain death' re-de- termines the biological fact of death; hence it is not merely a sign of death, it redefines death itself. In this way, the concept of 'brain death' reveals a di- mension of death that is open to manipulation. This bears the consequence of substantial erosion of fundamental moral values with respect to human life.[84]

In addition, there is an evident self-contradiction.[85] On the one hand, the concept of 'brain death' is based on the irreversible cessation of all

School to Examine Brain Death, in "Journal of the American Medical Association," 205, 1968, p. 337-340.

[76] Schadt, *Der Hirntod - Tod des Menschen?*, p. 5.

[77] Ischemia = Anoxia = disruption of oxygen supply.

[78] Spann, *Voraussetzungen der Explantation*, in *Rechtliche Fragen der Organtransplantation*, edited by Hiersche, Hirsch, Graf-Baumann, 1990, p. 21, 24.

[79] Beckmann, *Ist der hirntote Mensch eine 'Leiche'?*, in "ZRP," 1996, 219ff. (p. 222f.).

[80] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, p. 63.

[81] Schadt, *Zum Lebend-Status des Menschen im Zustand des isolierten Hirnfunktionsausfalles (dissoziierter Hirntod)*, 1999, p.3.

[82] H. Jonas, *Against the Stream. Comments on the Definition and Redefinition of Death*, p. 224.

[83] Federal Chamber of Physicians, in "Deutsches Ärzteblatt," Heft 44, 1993, p. B 2177-2179.

[84] Weber, *Der soziale Tod*, p. 323f.

[85] Beckmann, *Ist der hirntote Mensch eine 'Leiche'?*, p. 219ff. (p. 221).

brain function, and this is seen as "the irreplaceable physical condition of all emotional and psychic life."[86] On the other hand, explicitly irreversibly comatose patients and anencephalic children[87] are said to be alive despite the fact that in them, "specifically human conscious experience" has irre- versibly disappeared or perhaps never existed.[88] Persistent vegetative state[89] is seen as a "state of vegetative life." These patients live[90] entirely without the physical condition for an emotional or psychic life, and yet everyone agrees that they are alive.[91] Yet this clearly breaks with the basis of concept of 'brain death', i.e. the brain as condition of all emotional and psychic life.

2. *The Process of Dying as Part of Life*

In the meantime, it is generally known and agreed upon that dying is a process, something that occurs in time.[92] According to an opinion that is be- coming better known,[93] the criterion of 'brain death' merely says that patients have irreversibly begun to die[94] and that intensive medical care interventions

[86] Bundesärztekammer, in "Deutsches Ärzteblatt," 1993 (Heft 44), p. B 2177-2179.

[87] Anencephaly is a embryological developmental disease. It involves a malformation of the brain, especially the cerebrum. Due to an intact brain stem, these children can breathe sponta neously and also have intact cardiac activity. According to concepts of partial brain death, these patients are dead. Kloth, *Anenzephale als Organspender*, in "MedR," 1994, 180ff.

[88] Feuerstein, *Das Transplantationssystem*, 1995, p. 198ff.

[89] This refers to wide destruction of the cerebrum due to hypoxia with intact brain stem. These patients have intact respiration, brain stem reflexes, eye movements, sleep-wake-cycles. Zimmermann, *Bewusstsein - Bewusstlosigkeit - Koma*, 1988, p. 79f. and Wöbker, Bock, *Apallisches Syndrom - Vegetativer Zustand*, in *Das medizinisch assistierte Sterben*, edited by Holderegger, 2000, p. 267ff.

[90] Merkel, *Tödlicher Behandlungsabbruch und mutmaßliche Einwilligung bei Patienten im apallischen Syndrom*, in "ZStW," 107, 1995, p. 545 (p. 557 fn. 35 and 564), Merkel, *Hirntod und kein Ende*, p. 113ff. (p. 116).

[91] Wöbker, Bock, *Apallisches Syndrom - Vegetativer Zustand*, p. 267ff. (p. 276).

[92] Hufeland, *Die Kunst, das menschliche Leben zu verlängern*, 1797, p. 220, 237, 398.

[93] Grewel, *Zwischen Lebensrettung und Euthanasie - das tödliche Dilemma der Transplanta- tionsmedizin*, in "ZRP," 1995, 217ff.; Rixen, *Die Regelungen des Transplantationsgesetzes zur post- mortalen Organspende vor dem Bundesverfassungsgericht*, in "NJW," 1999, 3389 (3390) und aus- führlich Rixen, *Lebensschutz am Lebensende*; Tröndle, Fischer, StGB (49. Aufl. 1999), § 168 Rn. 4a und Vor § 211 Rn. 3ff.; Wagner, Brocker, ZRP 1996, 226 jeweils m.w.N. sowie die gesammelten Beiträge in *Wann ist der Mensch tot? Organverpflanzung und Hirntodkriterium*, edited by J. Hoff and J. in der Schmitten.

[94] Bavastro, *Das Hirnversagen und das Transplantationsgesetz*, 114ff.

only prolong[95] this process, but cannot stop it.[96] This means that the cessation of essential brain function[97] is a stage in the process of dying, but not its final end.[98] In fact, the process of dying is an "existential part of human ex- istence."[99] Hence, it would be right to say that the criterion of 'brain death' is suited to prove that the process of dying has irreversibly begun, thus re- lieving physicians of their duty to treatment in the sense of delaying death. There is probably general agreement that the criterion of 'brain death' should lead to the termination of further treatment.[100] Any further conclusions have rightfully been disclaimed as "repressive, manipulative reductions of the protected range of the right to life[101] through which the time point of death and its very definition have been altered. A highly technological medical discipline has been advanced[102] by means of moral philosophical arguments that have undermined the prohibition to kill."[103] In a certain sense, death becomes detached from the dying person,[104] and the cri- terion of 'brain death' "takes on a strategic goal-oriented character."[105] Un- doubtedly, the functions of other organs of brain-dead patients remain unim- paired, if they were not independently traumatized. In fact, the vitality of heart, lungs, liver, kidney and pancreas is the basic condition of transplantation. This problem can not be circumvented by saying that the death of a person does not necessarily imply simultaneous death of each of his bodily parts.[106] Death does

[95] Grewel, *Lohnen sich Organtransplantationen, in: Gehirntod und Organtransplantation als Anfrage an unser Menschenbild*, 1995, p. 66ff. (p. 69).
[96] Grewel, *Zwischen Lebensrettung und Euthanasie - das tödliche Dilemma der Transplanta- tionsmedizin*, in "ZRP," 1995, p. 217 (p. 218).
[97] Klein, in "Ethik in der Medizin," 1995, p. 6.
[98] Grewel, *Zwischen Lebensrettung und Euthanasie - das tödliche Dilemma der Transplanta- tionsmedizin*, p. 217ff.
[99] Schachtschneider, Siebold, *Die erweiterte Zustimmungslösung des Transplantationsgesetzes im Konflikt mit dem Grundgesetz*, in "DÖV," 2000, p. 129ff. (p. 131).
[100] Tröndle, *Der Hirntod, seine rechtliche Bedeutung und das neue Transplantationsgesetz*, p. 779ff. (p. 782).
[101] Höfling, *Um Leben und Tod: Transplantationsgesetzgebung und Grundrecht auf Leben*, in "JZ," 1995, p. 26.
[102] M. Quante, *Hirntod und Organverpflanzung*, in *Hirntod und Organverpflanzung*, edited by J.S. Ach and M. Quante, p. 21ff. (p. 21).
[103] M. Reuter, *Abschied von Sterben und Tod*, p. 40.
[104] Bayertz, *Ethik, Tod und Technik*, in *Hirntod und Organverpflanzung*, p. 79.
[105] Ibid., p. 86; Furger, *Probleme der Transplantationsmedizin aus theologischer Sicht*, in *Hirn- tod und Organverpflanzung*, p. 101ff. (p. 104).
[106] Angstwurm, *Wann ist ein Mensch wirklich tot?*, in *Gehirntod und Organtransplantation als Anfrage an unser Menschenbild*, p. 33ff. (p. 38).

not mean the final termination of all cellular and tissue life within the human organism;[107] nor do organs lead an isolated "separate existence." Instead, they stand in inseparable interaction with the entire organism.[108]

We must remember the following: despite the irreversible loss of all cere- bral, mid-brain and brain stem functions, these patients display spinal re- flexes,[109] have spontaneous blood pressure[110] and cardiac activity, have intact cellular oxygenation, assimilate parenteral nutrition and have bodily excre- tions, suffer from diarrhoea or constipation in the case of malnutrition, and show functional blood formation and coagulation. As well, certain parts of their metabolism are sustained, including some hormones. Wounds and frac- tures can heal in these patients, and even deceases like pneumonia can be cured. Corpses, in contrast, can not suffer from disease; disease is evidence for life![111] There is medical evidence for proportional bodily growth in three, and sexual development in two, brain-dead children.[112] There are also two reported cases of diabetes insipidus.[113] These patients also display uncoordi- nated vegetative reactions such as blushing, perspiration and muscle con- tractions. There are also records of complex movements of these patients.[114] In the biological sciences, these phenomena clearly belong to the purview of life.[115] Corpses are not capable of these things. When these patients are op- erated on, e.g. in the case of organ retrieval, they show typical vegetative re- actions, similar to healthy individuals under the same conditions. In this sense, surgical skin lesions cause unconsciously experienced pain, the pulse accelerates, the blood pressure rises, muscles contract and hormonal activity becomes increases enormously.[116] Descriptively, these are all attributes of

[107] Spittler, *Der Hirntod*, p. 128 (p. 135).
[108] Schadt, *Der Hirntod - Tod des Menschen?*, p. 10.
[109] The so-called Lazarus sign.
[110] Gramm, in "Intensive Care Medicine," 18, 1992, p. 493ff.
[111] Schadt, *Zum Lebend-Status des Menschen im Zustand des isolierten Hirnfunktionsausfall- es (dissoziierter Hirntod)*, p. 13.
[112] D.A. Shewmon, *'Brain-stem Death', 'Brain Death' and Death: A Critical Re-Evaluation of the Purported Equivalence*, in "Issues in Law & Medicine," 14, 2, 1998, p. 125-145.
[113] Outwater, Rockoff, *Diabetes insipidus accommpagnyng brain death in children*, in "Neu rology," 1984, p. 1243-1246.
[114] Linke, *Hirnverpflanzungen*, 1993, p. 119.
[115] Rixen, *Lebensschutz am Lebensende*, p. 277f.
[116] Gramm et al., *Hemodynamic responses to naxious Stimuli in braindead organ donors*, in "In tensive Care Medicine," 1992, p. 493ff.; Nanassis et al., *Vegetative Störungen und Entwicklung des sekundären Hirntodsyndroms*, in "Zentralblatt Neurochirurgie," 1995, p. 73ff.; Roudall et al., *Hemo- dynamic Responses in Brain Death Organ Donor Patients*, in "Anesthesia and Analgesia," 1985, p. 125ff.

life.[117] For this reason brain-dead patients are under full narcosis[118] during organ retrieval,[119] despite their putatively being dead. Finally, an embryo can develop until it becomes viable in such a patient. This occurred in 1991 in the Filder Clinic, when a baby was born that still lives healthily today, and in the spectacular case of Marion Ploch in Erlangen (Germany)[120] 1992 that ended in a spontaneous abortion.[121] "Is foetal development in the womb of the mother not one of the most wonderful, highly integrative manifestations of life that we know?"[122] In fact, it is precisely this "plurality of life,"[123] that makes the "particular one-dimensional cerebral ideology"[124] of the criterion of 'brain death' so attractive to organ transplantation.[125] Biologically, medically, and sci- entifically speaking, death can not be determined independently, but only in relation to life, as its end. Life itself can not be conceptually determined ei- ther, but must be described according to its attributes.[126] Consequently, all of these symptoms of life[127] indicate that the criterion of death does not describe death, but a process of dying that belongs to life. Otherwise, "the unity of body, soul and spirit which defines human life" is ignored.[128] Even 'brain death' experts speak of a "state of vegetative vitality."[129] In general the loss of fundamental conditions of independent bodily life does not mean the loss of life itself, but only the loss of the capacity for *independent* life.[130]

It is too simplistic to try to get rid of the 'uneasiness' associated with all of these symptoms of life by means of a highly technical concept of death. It

[117] Bavastro, *Das Hirnversagen und das Transplantationsgesetz*, p. 114 (p. 115).
[118] Muscle relaxants are always implemented.
[119] Sandvoß, *Anforderungen an ein Transplantationsgesetz*, in "ArztR," 1996, p. 151 (p. 153).
[120] Oduncu, Gruber, in "Medizinstrafrecht," 2001, p. 199ff. (p. 212ff.) bzw. p. 175ff.
[121] D.A. Shewmon, *'Brain-stem Death', 'Brain Death' and Death: A Critical Re-Evaluation of the Purported Equivalence*, p. 125-145. Shewmon reports on 13 cases of such pregnancies.
[122] Wodarg, member of the Bundestag, during a debate on transplantation law, vgl. BT-Drs. 13/183
[123] S.J. Youngner, *Brain death and organ transplantation: confusion and its consequences*, in "Minerva Anestesiologica," 60, 1994, p. 611-613.
[124] Höfling, *Um Leben und Tod: Transplantationsgesetzgebung und Grundrecht auf Leben*, p. 26.
[125] It is confusing and false to speak of inner decapitation in a medical sense. See Eigler, in "Deutsches Ärzteblatt," 1995, A-38.
[126] Angstwurm, *Wann ist ein Mensch wirklich tot?*, p. 33ff. (p. 34).
[127] Bavastro, *Das Hirnversagen und das Transplantationsgesetz*, p. 101ff. (p. 102f.).
[128] BVerfGE 56, 54ff. (75) and BVerfGE 88, 203ff. (252).
[129] G. Haeffner, *Hirntod und Organtransplantation*, in *Stimmen der Zeit*, 1996, p. 816.
[130] Schadt, *Der Hirntod - Tod des Menschen?*, p. 9.

does not suffice to argue that this merely "vegetative residuum of human life is not human anymore"[131] and that all arguments against 'brain death' are only emotional/psychological arguments that "lack comprehension of the prob- lem"[132] and stand in the way of rational acknowledgement of the theory of 'brain death'. It remains unsolved what this vegetative residuum might be, if it is not the elapsing life of a severely damaged human.[133]

3. *"Proximity of Death"*

At the same time we must get rid of a second bias. Just as it is uncertain to claim that a brain-dead patient is biologically dead, the repeatedly ad- vanced criterion of the immediate proximity of death is also uncertain. De- spite the fact that the process of dying has become final and irreversible af- ter "brain death," this does not imply the immediate proximity of death. The American neurologist Alan Shewmon shows clearly analysed medical cases of survival for at least a week in a large study of cases of 'brain death' between 1966 and 1997.[134] This occurs because e the initial cardio-vascular instability is increasingly compensated by the vegetative nervous system after 'brain death'. In 50 percent of the cases, Shewmon documented "survival times" of more than one month. The longest recorded survival following the correct di- agnoses of 'brain death' was 14.5 years![135] Thus, brain-dead patients have been released from intensive care units and referred to nursing homes; in one case, the patient could be cared for at home.

4. '*Brain Death' as an Independent Process*

Contrary to general opinion, the above discussion of the criterion for death shows that 'brain death' itself is not an event that occurs within a sec- ond or even within minutes as part of the process of dying, but is itself also a process, as is dying itself. "The time point of final diagnosis is documented,

[131] G. Haeffner, *Hirntod und Organtransplantation*, p. 812.

[132] Scientific Board of the Federal Chamber of Physicians, in "Deutsches Ärzteblatt," Heft 44, 1993, p. B 2177-2179.

[133] M. Reuter, *Abschied von Sterben und Tod*, p. 156.

[134] D.A. Shewmon, *Chronic 'Brain Death': Meta-analysis and Conceptual Consequences*, in "Neurology," 51, 1998, p. 1538-1545 and see also D.A. Shewmon, *'Brain-stem Death', 'Brain Death' and Death: A Critical Re-Evaluation of the Purported Equivalence*, p. 125-145.

[135] Probst, *Hirntod - Tod des Menschen?*, p. 6ff. (p. 7).

because, in 'brain death', the exact time point of death can not be precisely determined."[136] This total infarction of the brain that is referred to as 'brain death' comes closer to a severe disease than to an ultimate end in the process of dying. Thus, this criterion of death lacks two conditions of death: Firstly, the proximity of death, but then also the character of an event that allows the determination of the exact time of death.

5. *Discussion of the Quality of Life*

There is another important point to be made. It is generally agreed that hu- mans loose their legal right to protection neither because they no longer live up to certain cognitive or psychic criteria of achievement[137] nor because they are no longer in a "state of self-organized autonomic life."[138] It follows from the principle of absolute protection of life in Art. 2 par. 2 sent. 1 of the German Ba- sic Law that the terminally ill and the dying are to be respected regardless of their capacity for life, their life expectancy, chances of survival or life ambi- tions.[139] "Human life is absolutely worth sustaining."[140] Federal constitutional law explicitly states that neither "specifically human consciousness phenome- na, typical for a personality"[141] nor a "fully developed personality"[142] in this meaning of the word are necessary for the concept of life in Art. 2, par. 2 of the Basic Law. A definition of life that considers the capability for manifestations of consciousness is untenable according to the Constitution.[143] This is also sup- ported, because the concept of consciousness is not clearly defined,[144] and nei-

[136] Criteria of brain death of the Federal Chamber of Physicians in June, 1991, in "Deutsches Ärzteblatt," Heft 49, 1991 p. B-2855 to 2860.
[137] Maunz, Dürig, GG (Stand 1998) Art. 2 Abs. 2 Rn. 9; Höfling, *Hirntodkonzeption und Transplantationsgesetzgebung*, in "MedR," 1996, p. 5ff. (p. 6).
[138] Seewald, *Ein Organtransplantationsgesetz im pluralistischen Verfassungsstaat*, p. 199 (p. 214). The danger of implementing the same criteria in questions concerning the beginning of life needs to be pointed out. Such a definition of brain-life might lead to the assumption that human life begins only after a certain degree of neurophysiologic maturation. This sheds different light al so on the question of infanticide. Alexander (1987), 208ff. and Sass (1989), 160ff. (p. 174).
[139] BGHSt 7, 287 (p. 288).
[140] BGH NJW 1983, 1371 (p. 1373).
[141] BVerfGE 39, 1ff. (p. 37).
[142] BVerfGE 88, 203ff. (p. 251).
[143] Rixen, *Todesbegriff, Lebensgrundrecht und Transplantationsgesetz*, in "ZRP," 1995, p. 461 (p 463).
[144] Kurthen, Linke, Moskopp, *Teilhirntod und Ethik*, in "Ethik in der Medizin," 1989, 134ff. (p. 139).

ther its loss nor its presence can be scientifically proven.[145] According to the German constitution, human existence "is conceptualized inclusively, not ex- clusively." Any restriction of the fundamental status of being human is to be excluded.[146] Thus, the right to life is a "primal right of the individual."[147] In correlation, this must be valid also for the definition of death.[148] Hence, a concept of 'brain death' is incompatible with this premise too, if technical utilitarian definitions of death are to be prevented. It is important to realize the legal and ethical meaning of wanting to define death rather than docu- menting it. It is not necessary to speak of "the end of morality,"[149] but refer- ring to merely emotional doubts is not enough to withdraw from the ethical responsibility at hand.

For this reason, the degradation of the quality of life is often no longer related directly to the human. Instead people introduce the artificial moral-ethical concept of "the person." This "honorary title"[150] that goes back to[151] Aristotle's fundamental anthropological concept,[152] which today is consid- ered questionable,[153] is attributed to humans with certain cognitive qualities. It is withdrawn, on the other hand, from unborn life, but also from comatose and brain-dead patients, as if these humans did not have the same moral sta- tus as others. The human being is a person thanks to the quality of an "I that experiences and acts."[154] Self-consciousness is interpreted as the "mark of be- ing human."[155] This "philosophical corruption of medical technology"[156] al-

[145] Kurthen, Linke, Reuter, *Hirntod, Großhirntod oder aktueller Tod?*, in "MedKlinik," 1989, 483ff. (p. 485). If consciousness is understood as a measurable neural event, then the reasoning behind the concept of brain death is necessarily circular. For it aims at proving the loss of something that is part of its very definition, i.e. consciousness. Beckmann, *Ist der hirntote Mensch eine 'Le-iche'?*, p. 219ff. (p. 223).

[146] Rixen, *Lebensschutz am Lebensende*, p. 290f.

[147] Ibid., p. 291.

[148] Ibid., p. 281

[149] M. Reuter, *Abschied von Sterben und Tod*, p. 42.

[150] Ibid., p. 54.

[151] J.P. Beckmann, *Hirntodkriterium und menschliche Autonomie aus philosophisch-ethischer Sicht*, p. 18ff. (p. 24f.).

[152] Aristoteles, *Metaphysica*, VII; 1035b 24/25.

[153] I. Kant, *Krtik der reinen Vernunft*, A 333ff. as well as G. Ryle, *The Concept of Mind* (1949) [deutsch: *Der Begriff des Geistes*, 1969]) chapter 1.

[154] Spittler, *Der Hirntod*, p. 326.

[155] Thielicke, *Wer darf leben?* (1968) p. 38, 61f; Thielicke, *Fortschritte der Medizin* (1968) p. 1067.

[156] J. Seifert, *Hirntod: Ein Beitrag zur Kritik der philosophischen Korrumpierung der medi- zinischen Technik*, in *Ethik und Technik* (1988).

lows the old body-soul-dualism[157] to return in the form of a body-brain-dual- ism and suggests doing away with the ancient fundamental philosophical question "What is Man?."[158] People then no longer speak of biological death, but of "the death of humans as persons in this world."[159] These attempts of es- tablishing the person as characteristic of the human species, thus drawing a moral boundary within human existence must be counteracted right from the start, especially in the current bioethical debate on embryonic stem cells. Here too, our legal order does not allow "to pass judgement on the value of anoth- er's life."[160] This has been expressed in the following way: "The human him- self is the person, not a certain state of him."[161] In a mirror image of the abor- tion debate, which in the end had a very unfortunate result, we see the resur- gence of the attempt to differentiate between different stages of becoming hu- man or of dehumanization at the end of life. The quality of being human is then attributed to a correspondence with these developmental stages.[162] This is dangerous as it distorts the biology of life and must be rejected. Spittler, for example, speaks of a "late stage of dementia void of thought" and asks "which purpose does mere bodily survival serve in the case of final and complete loss of the ability for perception and social contact?"[163] According to this per- spective, demented life has the status of a cell culture.[164] There must be a clear opposition right from the start against attempts to establish a gradation of the value of different stages of life or "different stages of death."[165] "Man lives as long as he is dying,"[166] and it is inhuman to take "dying persons into public ownership on the basis of the medical primacy of life," as it is propagated to- day.[167] This implies a fatal confusion of consciousness and life[168] that makes it

[157] In the medieval ages, cruel tortures were put up with precisely because people deemed that the essence of the Man remained untouched, i.e. his soul.
[158] Kant, *Logik* (Akademieausgabe Bd. IX) 1923 p. 25.
[159] Spittler, *Der Hirntod*, p. 320.
[160] BGH NJW 1983, 1371 (1373).
[161] R. Spaemann, *Person ist der Mensch selbst, nicht ein bestimmter Zustand des Menschen*, in *Menschlichkeit der Medizin*, edited by Thomas, 1993, 261ff.
[162] BVerfGE 88, 203ff. (p. 267).
[163] Spittler, *Der Hirntod*, p. 325.
[164] U. Körtner, *Bedenken, dass wir sterben müssen*, p. 41.
[165] Oduncu, *Der „Hirntod" als Todeskriterium - biologisch-medizinische Fakten, anthropolo- gisch-ethische Fragen*, p. 199ff. (p. 229f.).
[166] Bockelmann, *Strafrecht des Arztes* (1968) p. 109.
[167] Schneider, '*So tot wie nötig - so lebendig wie möglich!' Sterben und Tod in der fortgeschrit- tenen Moderne*, p. 13.
[168] Bavastro, *Das Hirnversagen und das Transplantationsgesetz*, p. 101ff. (p. 104).

impossible to speak of the "residual life of a corps."[169] The event of death is a one-dimensional non-gradable value. It makes no sense to speak of being 'deader than dead'. Such confusing usage of terminology[170] such as distin- guishing between organic and personal death can compromise the protection of human life, especially when humans are most vulnerable.[171]

6. *In Dubio Pro Vita*

In this situation in which the progress of modern intensive care medicine has turned life into "a dark swamp with wide shores full of shadows and vague boundaries,"[172] we must conclude that the legitimacy of the criterion of 'brain death' can be challenged with reasonable, scientific insights[173] that have not been disproved by the current doctrine.[174] In this "twilight zone of doubt,"[175] there has been a loss of clarity of the boundary between life and death.[176] Theologians and philosophers are formulating theses and discussing them.[177] But the principle of "in dubio pro vita"[178] must be applied when legal norms make decisions and create "real standards."[179] In these cases, we must bring to bear the fact that "human life is of the highest value[180] in our constitution."[181] Correspondingly, well-known experts of constitutional law have concluded that "the brain-dead patient lives in the constitutional sense of the word,"[182] and the criterion of 'brain death' does not mean the death of

[169] Oduncu, *Der „Hirntod" als Todeskriterium - biologisch-medizinische Fakten, anthropolo- gisch-ethische Fragen*, p. 199ff. (p. 229).
[170] Tröndle, in Bd. II (Sitzungsberichte) M 29ff. (M 37).
[171] M. Reuter, *Abschied von Sterben und Tod*, p. 71.
[172] R. Stoecker, *Der Hirntod. Ein medizinethisches Problem und seine moralphilosophische Transformation*, Freiburg/München, Verlag Karl Alber, 1999, p. 86.
[173] Linke, *Hirnverpflanzung* (1993), 123f.
[174] Heun, *Der Hirntod als Kriterium des Todes des Menschen*, 213ff. (p. 216).
[175] Wagner, Brockner, *Hirntodkriterium und Lebensgrundrecht*, in "ZRP," 1996, 226ff. (p. 227).
[176] Cited according to Rixen, *Lebensschutz am Lebensende*, p. 177 (in fn. 745).
[177] Schreiber, *Wann darf ein Organ entnommen werden?*, in *Hirntod und Organverpflanzung*, edited by J.S. Ach and M. Quante, p. 199ff. (p. 199).
[178] Höfling, *Plädoyer für eine enge Zustimmungslösung*, in "Universitas," 1995, p. 362; Höfling, *Hirntodkonzeption und Transplantationsgesetzgebung*, in "MedR," 1996, p. 6ff. (p. 8).
[179] Rixen, *Todesbegriff, Lebensgrundrecht und Transplantationsgesetz*, p. 461 (p. 464).
[180] Steiner, *Der Schutz des Lebens durch das Grundgesetz* (1992), p. 13.
[181] BVerfGE 39, 1ff. (42); 46, 160ff. (164); 49, 24ff. (53).
[182] Rixen, *Lebensschutz am Lebensende*, p. 23 mit umfangreichen weiteren Nachweisen [in F. 70] und *Dreier/Schulte-Fielitz*, GG Art. 2 Abs. 2 Rn. 1.

a human,[183] but only documents the irreversibility and the finality of his dy- ing.[184] From this perspective, the criterion of 'brain death' leads to "declaring humans as dead at a certain time in the process of dying that clearly belongs to life."[185] For this reason, the basic right to life in Art. 2 II 1 of the Basic Law, protects this life as mere biological-physical existence[186] without assessing according to the standards of social expressions of life.[187] This version of the basic right to life is a normative reaction of the fathers of the Constitution to the experiences of the then recent German history. Within the constitutional order it represents a highest value according to federal constitutional law.[188] The search for the justification of the criterion of 'brain death' might indicate a confusion of consciousness and life that escapes our epis-temic abilities. Current literature on near death experiences[189] indicates possible forms of consciousness beyond the range of medical observation.[190] This suggests that we must be alert and that there are no simple truths in this area. Given the cognitive inaccessibility of the border zone between life and death, no one can anticipate the consequences of removing any single foundation of the protection of life.[191] The existentially significant concept of death should be determined in such a way that the proposition "this human is dead" is true unambiguously, independently of any persons convictions and without need of further differentiation.[192] It is to be rejected that medicine has a different concept of death than funeral parlours, for "life and death are single-digit non-relational terms."[193] Hence, it must be unmistakeably documented that 'brain death' does not describe death as a final state, but rather an irreversible state that authorises us to allow death to occur. Let us allow brain-dead pa- tients to die rather than declaring them dead prematurely!

[183] Tröndle, STGB (48. Aufl. 1996) Vor § 211 Rn. 3a etwa bezeichnet den Hirntoten hier im Zitat als einen "zu 97% Lebenden ohne Hirnfunktion."

[184] Grewel, *Zwischen Lebensrettung und Euthanasie - das tödliche Dilemma der Transplanta- tionsmedizin*, p. 217 (p. 218).

[185] Quante, *Hirntod und Organverpflanzung*, p. 27.

[186] Jarass, in Jarass, Pieroth, GG-Kommentar (3. Aufl. 1995) Art. 2 Rn. 44.

[187] Maunz, Dürig, GG (Stand 1998) Art. 2 Abs. 2 Rn. 8-12 und BVerfGE 88, 203 (254ff.).

[188] BVerfGE 49, 24 (53).

[189] Brinkley, Perry, Zurück ins Leben (1994); Moody, Das Licht von drüben (1989); E. Kübler- Ross, Was können wir noch tun? (1977); Roszell, Erlebnisse an der Todesschwelle (1993).

[190] Probst, Hirntod - Tod des Menschen?, unter 5.1 b, p. 6ff. (p. 12).

[191] Steiner, Der Schutz des Lebens durch das Grundgesetz, p. 25.

[192] Birnbacher, Fünf Bedingungen für ein akzeptables Todeskriterium, p. 58.

[193] Ibid., p. 62.

Are "brain dead" (or "brain-stem dead") patients neurologically recoverable?

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Introduction

This chapter is written to further explore unrecognized pathophysiological, legal and ethical issues related to "brain death" (BD) or "brain-stem death" (BSD). Their existence and importance for the recovery of patients in that condition could be perceived during the attempts to reanimate the brain of a young female patient declared "brain dead" within less than 36 hours from a severe head trauma.

On January 3rd, 2007, a 15-year old previously healthy girl (here referred to as BBA) was run over by a car when she was cycling in a littoral town of southern Brazil, while on summer vacation. At 1:00 PM she was admitted to the emergency room of the nearest medical center (an active hospital in organ transplantation located in the city of Joinville, State of Santa Catarina, 41 km away from the accident scene) after a 15- min cardio-respiratory arrest managed by the personnel of the ambulance helicopter. At 3:30 PM a neurosurgeon reported Glasgow Coma Scale (GCS) score of 4, "medium-fixed pupils," "presence of respiration." A CT scan revealed brain edema (more prominent in the right cerebral hemisphere), right-sided laminar subdural haematoma and possible uncal herniation. Upon admission to the intensive care unit (ICU), she received continuous intravenous midazolam associated with fentanyl. Both were stopped by a neurosurgeon in the morning of January 4th (8:20 AM) to start procedures for the diagnosis of BD. The first apnea test (reported to last 10 minutes, following a record of "absent brain-stem reflexes") was performed at 2:00 PM and repeated (reported to last 12 minutes, again following a record of "absent brain-stem reflexes") after an unrecorded elapsed time from the first test, with no spontaneous respiratory effort reported on either occasion. During the night of January 4th she was declared "brain dead" following a 4-vessel angiography showing no contrast opacification of all intracranial vessels. On January 5th she had a second cardiac arrest, promptly followed by successful electrical cardioversion.

Under deep emotional trauma, aggravated by perceiving the treatment that preceded the diagnostic procedures for BD as excessively short or limited, her mother eventually declined repeated requests for organ donation, and decided to move BBA to her home city. The family paid an amount equivalent to approximately US$5,000.00 to transport the patient in an aircraft equipped to be a mobile ICU to another hospital ICU (located about 400 km away, in Sao Paulo city) where she arrived on January 7th. Upon admission, the girl was examined by a second neurosurgeon who wrote a chart note recording the absence of several brainstem reflexes (caloric tests and apnea not mentioned) and, again, declared BD based on her neurological condition and on a copy of the angiogram report from Joinville.

During the night of January 8th, upon being contacted by the family, I found her with a GCS score of 3, absent brainstem reflexes, including asymmetric pupils fixed to light and absent response to caloric stimulation, apnea test not performed. She was sustaining normal body temperature, polyuric, requiring continuous noradrenaline infusion for maintenance of blood pressure, and receiving a 600-calorie diet via a nasoenteric feeding tube. Laboratory tests showed impaired renal function, hypoalbuminemia and hypernatremia. The copy of the patient's chart from the hospital in Joinville contained only short notes on the duration of the 2 apnea tests, with no description of pre- and passive oxygenation measures or the state of the patient's vital signs (other than absent respiratory efforts) during the test. Testing of other brain stem reflexes was not reported. Serum sodium levels were reported as 160, 181 and 159 mEq/L respectively on January 3rd, 4th and 5th, 2007.

Based on the hypothalamic maintenance of body temperature and signs of sustained (although decreased) blood flow through the retinal vessels (vascular refilling upon releasing of a gentle compression laterally applied to the ocular globe) on fundoscopic examination (particularly visible on the left side), I told the family and the ICU staff that there could be intracranial blood flow enough to sustain hypothalamic activity and possibly some vitality of the remaining brain tissue, but not enough

circulatory levels to allow contrast opacification of intracranial vessels and the activity of the (higher energy-consuming, synaptic circuitry- dependent) specific set of brain functions currently evaluated for the diagnosis of BD. According to the concept of global ischemic penumbra [Coimbra, 1999], those functions could conceivably resume in some BD/BSD patients, provided that a non-conventional treatment is carried out and enough recovery time elapses. Due to the detrimental effects of 2 apnea tests, 2 cardiac arrests, and the time elapsed from the primary insult without any effective neuroprotective or anti-edema treatment (5 days), it was recognized that the neurological recovery of BBA would still be highly unlikely.

By the second half of January, secondary hypothyroidism and secondary hypoadrenalism had become apparent and were treated, the patient stabilizing hemodynamically to the point of requiring no vasopressor infusion for several consecutive days or even weeks. She intermittently required only minimal vasopressor infusion for a few hours during pneumonic episodes and/or urinary tract infections, when the doses of hormone replacement therapy had to be adjusted to meet a higher demand. Her creatinine and BUN levels were already normalized in February, and creatinine dropped to low levels thereafter, probably as a consequence of hypoalbuminemia secondary to massive proteinuria.

By the middle of February 2007, BBA started having seizure-like episodes – rhythmic clonic jerks affecting most prominently the arms and the left side, which usually subsided within one or two minutes after the intravenous injection of 10 mg of diazepam, or might last more than 10 minutes if left untreated. In addition, reflex jaw closing and lip protrusion, triggered by oral hygiene with an undiluted bitter-tasting solution, were noted. Most importantly, BBA started triggering 2-3 ventilator cycles each minute in addition to the pre-set respiratory frequency of 15 cpm, with the flow trigger set at 1 L/min. When the ventilator-commanded frequency was set at zero cpm, flow trigger at 1 L/min, and the support pressure set at 16 mmHg above PEEP she would trigger about 11-12 cycles in the first min and 6-8 cycles in the second minute; the test was then discontinued to avoid oxygen desaturation. When she was

disconnected from mechanical ventilation, respiratory efforts were not visible for 40 seconds – at which point oxygen saturation fell below 90 % and the test was discontinued.

In the second half of January, BBA had clear signs of improved retinal circulation, while her conjunctival vessels became visible and dilated. She had 3 transcranial Doppler ultrasonographic examinations on January 10th, March 6th and June 25th. Results were "no signs of intracranial blood flow" (first examination), "residual blood flow in both carotid siphons and ophthalmic arteries, without signs of brain parenchymatous blood flow" (second examination) and "unchanged" (third examination). Seven CT scans (done between January 15th and June 6th) consistently reported diffuse brain edema with collapse of the whole ventricular system. She had an angio-MRI scan done on April 14th with no signs of intracranial blood flow, while a simultaneous traditional MRI revealed diffuse signal changes, but preserved distinction between grey and white matters, with signs of ischemic demyelenation. There was actually no cerebral edema and the supratentorial ventricles were clearly visible and normal in size. This indicates that cerebro-spinal fluid with altered density (similar to brain parenchyma) in BD patients may lead to a mistaken diagnosis of ventricular collapse resulting from cerebral edema in CT images. Nevertheless there was persistent edema of the infra- tentorial structures, with cerebellar tonsillar herniation through the foramen magnum. By the time when BBA's MRI studies were done, she had shown no neurological reactivity for about 45 days. A period of hypotension, worsening of metabolic disturbance and electrolyte imbalance at that point was associated with further pupil dilatation (from 3.5 mm to 8.0 mm in diameter). Her pupils returned to medium-fixed level upon correction of those abnormalities – a functional evidence of sustained blood flow to the mesencephalon.

On June 19th BBA underwent 19-channel EEG monitoring (EEG was previously unavailable within the hospital) for 2 hours, which demonstrated low amplitude cerebral activity of predominantly alpha rhythm, suggestive of alpha coma. No epileptiform activity was recorded. In spite of that, the third transcranial Doppler ultrasonographic examination (of June 25th) was reported as "unchanged."

During the month of August 2007, BBA was under respiratory training, capable of maintaining the triggering of 14-20 respiratory cycles per minute for an average period of 12 hours when the ventilator trigger (sensitivity) was set at 1 L/min (support pressure at 18 cm of H2O above PEEP), but only for 30-60 minutes with the sensitivity set at 2 L/min.
Respiratory training was interrupted in case of hypotension or diazepam administration. She had eight seizure-like episodes in June, three in July and none in August 2007, most of them responsive to a single i.v. injection of 10 mg diazepam.

BBA's clinical problems included hypoalbuminemia (initially requiring human albumin administrations) associated with proteinuria and recurrent ventilator-associated pneumonias caused by antibiotic-resistant gram negative bacilli. Proteinuria (initially massive – up to 70 grams per 24 hours) of unknown cause responded partially to thyroid hormone replacement (when it dropped to about 15 grams per 24 hours), and to elevation of serum phosphate levels to the upper normal range (dropping in August to about 5 grams per 24 hours). Concomitant glycosuria without hyperglycemia (about 5 g per 24 hours) dropped to about 1 g per 24 hours and then to within the normal range, following those 2 respective measures. BBA no longer required human albumin administrations for the last few months, receiving a 1,600-calorie enteric diet plus 40 grams of additional casein protein 4 times per day. Under that regimen her serum albumin level (previously as low as 1.6 g/dL) varied between 2.4 and 2.9 g/dL. Her level of diuresis throughout the 24 hour period dropped from approximately 15 L to 5 L, requiring less frequent nasal instillations of DDAVP (1-desamino-8-D-arginine vasopressin).

Ceasing i.v. administrations of dimethyl-sulphoxide (DMSO) for 1 month did not change proteinuria levels, and was associated with decreased lung compliance (probably as a result of non-antagonized oxidative lung injury, secondary to recurrent pneumonias and/or to prolonged oxygen therapy). Conversely, resuming DMSO treatment progressively normalized lung compliance. In the last couple of months, the frequency of recurrent pneumonic episodes decreased sharply with (1) spraying rifocin into the tracheostomy tube every eight hours, (2) avoiding instillation of physiologic saline into the tracheostomy tube

before suctioning of respiratory secretions, and (3) avoiding unnecessary nebulization of bronchodilator aerosols (when there is no bronchospasm) or saline (adequate fluidity of respiratory tract secretions preferentially maintained by systemic hydration and oral administrations of N-acetyl cysteine – a mucolytic agent with anti-oxidant properties, and also a precursor of reduced glutathione).

BBA initially required frequent red blood cell and platelet transfusions to correct anemia and thrombocytopenia. She developed very high serum ferritin (3978 ng/mL, normal range 10-291 ng/mL), high serum iron (224 µg/dL, normal range 37-145 µg/dL), and decreased transferrin levels (92 mg/dL, normal range = 200-360 mg/dL), with increased tranferrin saturation (89.7%, normal range = 15-50%), and low serum levels of copper and ceruloplasmin. Disturbed iron metabolism was possibly the result of the combined effect of proteinuria (with urinary transferrin loss) and repeated red blood cell transfusions (required before thyroid hormone replacement). Increased free iron (due to low tranferrin levels) may have been worsened by iron overload (caused by repeated blood transfusions) and reduced ferroxidase activity due to low serum levels of ceruloplasmin [Madsen and Gitlin, 2007]. High ferritin levels were sustained even between infection disorders (therefore it was not a simple expression of acute phase reaction) and may have developed as a compensatory mechanism to minimize the detrimental effects of free iron on the brain and other tissues. BBA eventually required iron chelation therapy with continuous subcutaneous infusion of desferrioxamine until her serum free iron decreased to normal range. Concomitant thyroid hormone replacement increased her red cell production (thereby consuming accumulated iron stores) and (by decreasing proteinuria) may have minimized urinary transferrin loss – two mechanisms that may help in reducing free iron. Thyroid hormone (triiodothyronine – T3, and thyroxine – T4) replacement was titrated according to the serum levels of free T4 and free T3. Administrations of T4 alone corrected free T4 levels, but not T3 levels. BBA initially required up to 400 µg of T4 and 200 µg of T3 (divided into 3-4 doses) to maintain her free T4 (FT4) and free T3 (FT3) serum levels within the normal range. Urinary loss of hormones bound to TBG (Thyroid hormone Binding Globulin) resulting from

BBA's proteinuric state may conceivably have contributed to such an exceptionally high demand for thyroid hormones. In accordance with that idea, the progressive decrease of BBA's proteinuric levels was associated with a reduced demand for thyroid hormones, so that in the month of August she was requiring 150 µg of T4 once a day and 25 µg of T3 three times a day to maintain circulating levels of FT4 and FT3 within the normal range.

Implications of hypothyroidism and hypoadrenalism (secondary to hypothalamic failure) for the diagnosis and treatment of "brain dead" or "brain-stem dead" patients.

Hypopituitarism caused by head injury and aneurysmal subarachnoid hemorrhage (2 of the major causes of BD/BSD) has been incidentally diagnosed months or years after insult. Pituitary dysfunction after TBI is now recognized to be more common than previously appreciated, with up to 30–70% prevalence among survivors. Deficiency of gonadotrophins (FSH/LH), growth hormone (GH), adrenocorticotrophin (ACTH), thyrotrophin (TSH) has been reported. Injury severity and secondary cerebral insults are risk factors for hypopituitarism. Recently, these neuroendocrine abnormalities have been identified in the acute phase of brain injury with high frequency. Although data emerging since 2000 demonstrate the relevance of the problem, in general there is a lack of awareness in the medical community about the clinical importance and implications of these findings for neurological recovery and rehabilitation [Winternitz and Dzur, 1976; Kelly et al, 2000; Agha et al, 2004a; Agha et al, 2004b; Aimaretti et al, 2005; Popovic et al, 2005a; Popovic et al, 2005b; Kelly et al, 2006; Herrmann et al, 2006; Mocchegiani et al, 1995; Takala et al, 2006]. Similar neuroendocrine changes have been reported in patients with acute space occupying ischemic stroke [Schwarz et al, 2003].

Early identification and replacement therapy of TBI-induced *thyroid* dysfunction may be particularly relevant for recovery from TBI and rehabilitation outcome. In the study by Woolf et al [1988] T3 and T4 levels fell significantly within 24 hours of injury; four days after the accident, patients with the greatest neurologic dysfunction had the lowest T3 and T4 levels; patients who died, developed BD/BSD, or remained vegetative had T3 and T4 levels 30% to 50% significantly lower than those who had a good recovery. The correlation between thyroid hormone levels and outcome was confirmed in the study by Mocchegiani et al [1995]. Later, Tenedieva et al [2000] demonstrated that the recovery from coma coincides with normalization of the thyroid hormone function and reduction of brain injury markers, recommending adequate T3 replacement therapy in the early post-traumatic period.

Thus, patients with TBI exhibit a gradient of thyroid dysfunction that occurs promptly, correlates with the degree of neurologic impairment, and forecasts ultimate outcome [Woolf et al, 1988]. Rather than simply reflecting the degree of brain injury, as suggested by Cernak et al [1999], the lack of timely resumption of thyroid hormone actions in the injured brain may contribute to or even determine a poor neurologic outcome [Tenedieva et al, 2000]. That is indicated by a number of data, and has major implications for the treatment of coma (associated with conditions like severe TBI, aneurysmal hemorrhage and space occupying ischemic stroke) and for the diagnosis of BD/BSD. First, hypothyroidism may itself impair consciousness [Royce, 1971; Blum, 1972] and, therefore, secondary hypothyroidism may contribute to the degree of coma and related complications observed in victims of brain damage.

Second, increased transcapillary leaking of the plasma proteins such as albumin, occurs in hypothyroid patients, and may lead to proteinuria, generalized edema (myxedema), pleural and pericardial effusions and ascites [Parving et al, 1979; Wheatley and Edwards, 1983]. Brain myxedema may also occur, both in the newborn [Kaye, 2006] – possibly facilitated by incomplete development of the fetal blood-brain barrier – and in adults [Blum, 1972]. Therefore, unrecognized secondary

hypothyroidism may conceivably make vasogenic brain edema (primarily determined by events like trauma, ischemia and hemorrhage) unresponsive to conventional treatment. In addition, hypothyroidism may cause intracranial hypertension by other mechanisms [Schexnayder and Chapman, 2006].

Third, severely hypothyroid patients have diminished ventilatory drive to both hypoxia and hypercarbia [Massumi and Winnacker, 1964; Domm and Vassallo, 1973; Zwillich et al, 1975; Jordan, 1995], and recovery from respiratory failure caused by hypothyroidism may be remarkably slow [Fan et al, 2005]. As hypothyroidism develops within a few hours in TBI patients, and the severity of thyroid hormone deficiency correlates with the degree of neurologic dysfunction [Woolf et al, 1988], the specific patients selected for verification of BD/BSD may largely coincide with those who have the most severe deficiency of thyroid hormones. Therefore, a number of them may be unresponsive to apnea testing as a consequence of their hypothyroid state, and not as a consequence of irreversible structural damage to the respiratory centers. In addition, circulatory levels within the range of ischemic penumbra may further contribute to inactivation of the respiratory reflex without irreversible damage to respiratory centers [Coimbra, 1999].

On the other hand, patients with untreated hypothyroidism are particularly sensitive to the actions of central nervous system (CNS) depressants like barbiturates, developing significant respiratory depression and coma [Mitchell et al, 1959; Nickel and Frame, 1961; Larsen and Davies, 2003; Jameson and Weetman, 2005]. High doses of barbiturates are widely used for the management of severe head injury patients with intracranial hypertension [Maas et al, 1997; The Brain Trauma Foundation, 2000]. Conversely, drug metabolism is decreased in hypothyroidism [Eichelbaum, 1976; Haas et al, 2000]. For instance, thyroxin is a potent activator of the CYP3A enzyme system [Haas et al, 2000] – one of the most important cytochrome P-450 subfamilies, playing a significant role in the metabolism of approximately half of the drugs in use [Guengerich, 1999]. Midazolam (administered to BBA at hospital

admission) is an anesthetic mainly metabolized by CYP3A [Reves et al, 1985], and is widely used in combination with phentanyl for continuous sedation in critically ill patients [Muellejans et al, 2006]. Clearly, the conventional therapy is in conflict with current diagnostic protocols for BD/BSD – the apnea test being performed in some (or most) patients having their respiratory drive depressed or annulled by secondary hypothyroidism, many of whom are under the residual or potential effect of CNS depressants. Accordingly, Meinitzer et al [2005] found delayed elimination of midazolam and/or midazolam metabolites in "potential organ donors."

Moreover, BBA showed an initial pattern of respiratory recovery that is not considered in apnea tests. Her inspiratory effort, although so subtle as not to be visually apparent, was strong enough to trigger mechanically assisted respiratory cycles for several hours, provided that the ventilator was set at high sensitivity levels. The possibility of erratic mechanical ventilatory cycles in a highly sensitive support system (triggered by oscillations of its latex tubular connections to the tracheostomy tube) was considered initially, when only a few cycles could be demonstrated under a ventilator-commanded frequency set at zero cpm. At that time, resumption of ventilator commands became mandatory within a couple of minutes to avoid oxygen desaturation. However, her inspiratory effort observed during August 2007, even not visually perceived, was nevertheless strong enough to sustain a consistent frequency of mechanically assisted respiratory cycles for up to 17 hours with the trigger set at sensitivity of 1 L/min, or 2 hours at sensitivity of 2 L/min – interrupted only during the night, to avoid problems related to a less consistent vigilance. Accordingly, a hypothyroid patient sustained long apneic periods (up to 70 seconds) with persistent intrathoracic pressure fluctuations, when only careful observation revealed rhythmic movements of the abdominal wall – consistent with diaphragmatic contractions and relaxations, even though the glottis seemed to remain closed [Massumi and Winnacker, 1964]. This raises the possibility that comatose patients with similar subtlety of respiratory responses due to secondary hypothyroidism may be routinely labeled as unresponsive to the apnea test as it is currently carried out (visually evaluated) for BD/BSD diagnosis.

Fourth, thyroid hormone functions include trophic and regenerative actions in the nervous system that may be critical for recovery from brain damage. Thyroid hormone receptors are expressed in neurons, oligodendrocytes, and astrocytes, both in mature and developing brain [Carlson et al, 1994; Anderson, 2001; Galeeva et al, 2002]. The roles of the thyroid hormone in brain development are better known than in adult brain, and include axonal and dendritic growth, synapse formation, myelination, cell migration, and proliferation of specific populations of cells, as a result of organized regulation of gene expression [Anderson, 2001].

A number of data point to persistent fundamental functions in the mature CNS. Hypothyroidism is associated with pathologic changes in the adult brain [Nickel and Frame, 1961; Massumi and Winnacker, 1964]. Hypo and hyperthyroidism are associated with neuropsychiatric disorders and seizures [Sanders, 1962; Anderson, 2001], and hypothyroidism is associated with several other neurologic disturbances that demonstrate the existence of fundamental physiologic actions of the thyroid hormones in the mature nervous system. Those include generalized loss of amplitude of electroencephalographic recordings, impaired reflex responses (including impairment of cranial nerve function), increased cerebral vascular resistance, reduced cerebral blood flow, respiratory failure requiring artificial ventilation, coma and death [Nickel and Frame, 1958; Sanders, 1962] – all of them highly relevant for the outcome and/or for the diagnosis of irreversibility of brain damage. Thyroid hormones induce neurogenesis even in the mature brain [Ambrogini et al, 2005; Desouza et al, 2005]. Other neurotrophic functions may also persist in the mature mammal and contribute to recovery of the damaged nervous tissue, promoting post-lesional remyelination [Calza et al, 2005] and survival of ischemic neurons [Hiroi et al, 2006].

Thus, following TBI, aneurysmal subarachnoid hemorrhage or other damaging events, unrecognized severe secondary hypothyroidism may cause progression of comatose patients into irreversible brain damage by a number of mechanisms, including intractable brain edema and intracranial hypertension, hypotension, respiratory failure, and loss of neurotrophic and regenerative functions dependent on thyroid hormones. However, the neurologic manifestations of thyroid dysfunction in the

adult brain are usually reversible with return of the patient to the euthyroid state [Swanson et al, 1981]. Therefore, by the time when they fulfill the diagnostic criteria for BD/BSD, an unknown number of deeply comatose individuals may still respond to non-conventional treatments that include thyroid hormone replacement.

Surprisingly, although “severe endocrine disturbance” is listed among the confounding conditions in the diagnosis of BD/BSD [Wijdicks, 1995; Wijdicks, 2001] – primary hypothyroidism being specifically included [Burns and Login, 2002] – secondary hypothyroidism is never taken into account in the same way, and thyroid hormone replacement has been considered only for “donor care” [Powner and Hernandez, 2005].

Fifth, a worldwide rationale for the diagnosis of BD/BSD is that the destruction or “irreversible loss” of brain functions (the "central integrator" of the body), entails a loss of somatic integrative unity, leading to disintegration of the organism as a whole, and the "point of no return" is allegedly identified by meeting the current criteria for the diagnosis of BD/DSD. As a consequence, “somatic death” (irreversible cardiac arrest following multiple-organ failure) would occur within a matter of days despite “maximal” therapy – arguments reviewed by Shewmon [1998]. An early diagnosis of BD/BSD would, therefore, be justifiable to avoid “futile” treatment and enable harvesting of transplantable organs and tissues while they are still in good condition [Van Velthoven and Calliauw, 1988]. In disagreement with that long sustained rationale, Shewmon [1998] reviewed 175 BD/BSD patients who survived 1 week or longer and reported on individuals who survived months or years. However, that rationale referred to is so vigorously defended that others were skeptical about the validity of BD determinations in the cases reviewed by Shewmon [Wijdicks and Bernat, 1999]. Indeed, general acceptance of the concept of brain death depended on this close temporal association between brain death and cardiac arrest [Shewmon, 1998].

The severe neuroendocrine dysfunctions unveiled during the attempts to recover BBA, as well as data emerging after the year 2000 [Popovic et al, 2005a; Popovic et al, 2005b], emphasize the clinical importance and implications of these changes for neurological recovery and rehabilitation, and demonstrate that the comatose patients selected for the diagnosis of BD/BSD are far from being maximally treated, either neurologically or clinically. Probably, most (if not all) comatose patients selected for the diagnosis of BD/BSD have two associated (invariably lethal, if untreated) conditions that are currently left unrecognized: severe hypothyroidism and hypoadrenalism. Accordingly, hypopituritarism is associated with coma and respiratory depression, and also noticeably lethal if left untreated [Sheehan and Summers, 1949].

Adequate adrenocortical function is essential to survive critical illness. Most critically ill patients display an elevated plasma cortisol level, reflecting activation of the pituitary-adrenal axis, which is considered to be a homeostatic adaptation to severe insults such as trauma, sepsis or major surgery. In the setting of critical illness, the failure of an appropriate neuroendocrine response can lead to the picture of vasopressor-dependent refractory hypotension [Beishuizen and Thijs, 2001]. This state of relative adrenal insufficiency or "adrenal exhaustion" (characterized by an inadequate production of cortisol in relation to an increased demand during periods of severe stress) is emerging as an important cause of excess morbidity and mortality in critically ill patients [Beishuizen and Thijs, 2004; Marik, 2006], including victims of severe TBI [Dimopoulou et al, 2004]. Evidently, among all of the critically ill, victims of severe brain damage associated with hypothalamic dysfunction and impaired ACTH secretion will develop the most profound levels of adrenal failure.

Severe primary hypothyroidism associated with coma is a fatal condition when left unrecognized [Jordan, 1995], and untreated (secondary) profound hypothyroidism associated with conditions like severe TBI or subarachnoid hemorrhage may likewise cause death.
Hypothyroidism causes refractory hypotension [Gupta et al, 1992] by

mechanisms that probably involve impaired atrial natriuretic hormone secretion and reduced activity of the renin-angiotensin-aldosterone system, which can be corrected by thyroid hormone replacement [Park et al, 2001]. Evidently, secondary hypothyroidism and hypoadrenalism may combine to induce vasopressor-dependent refractory hypotension and further reduce cerebral blood flow in critically ill victims of brain damage associated with brain edema and intracranial hypertension.

The apnea test – which is considered essential for identification of the "point of no return" – may aggravate hypotension and intracranial hypertension, thereby further reducing blood flow, with disastrous consequences for neurological recovery (including further hypothalamic damage) and survival of the subset of those comatose patients that would be still recoverable by therapeutic measures (encompassing thyroid and adrenal hormone replacement) at the time when the test is implemented [Coimbra, 1999]. Apart from reflecting irreversible damage to the brainstem, a negative response to the apnea test may alternatively result from (1) subtle respiratory efforts undetected by visual assessment, (2) reduction of the blood flow to respiratory centers down to the range of ischemic penumbra by intracranial hypertension and arterial hypotension – both worsened by the apnea test itself [Coimbra, 1999], and (3) impaired responsiveness of the respiratory centers to carbon dioxide due to unrecognized secondary hypothyroidism.

Altered capillary permeability to plasma proteins due to thyroid hormone deficiency may not only lead to refractoriness of brain edema to conventional therapies in comatose victims of severe brain damage, but may also cause other vital organ dysfunctions that also compromise survival and brain reanimation. An increased transcapillary leaking of the plasma proteins leading to proteinuria, generalized oedema, pleural and pericardial effusions and ascites has been classically reported in hypothyroid patients [Parving e al, 1979; Wheatley and Edwards, 1983].

Renal function improves during treatment of hypothyroidism and decreases during treatment of hyperthyroidism, demonstrating the

importance of the kidney as a target of thyroid hormone action [Mooraki et al, 2003; den Hollander et al, 2005]. Experimental hypothyroidism causes glomerular lesions [Green et al, 1974], and focal segmental proliferative glomerulonephritis has been reported in hypothyroid patients [Ogata et al, 2000]. Hypothyroidism causes and/or aggravates proteinuria [Narayan et al, 1995; Mooraki et al, 2003]. Conversely, proteinuria may aggravate hypothyroidism. Proteinuria correlates with urinary loss of thyroid hormones (T3 and T4) and thyroid hormone binding proteins (thyroid hormone binding pre-albumin, TBPA, and thyroid hormone binding globulin, TBG). Therefore, proteinuria increases the demand for thyroid hormone production in euthyroid subjects [Adlkofer et al, 1983] and, if massive enough, may even cause hypothyroidism [Chadha and Alon, 1999]. Plausibly, proteinuria also increases the demand for hormone replacement in hypothyroid patients. This is consistent with the high doses of T3 and T4 initially required to achieve BBA's euthyroid state (according to FT3 and FT3 levels), as well as with the reduction of replacement doses accompanying the improvement of proteinuria.

In patients with hypopituitarism, hypoalbuminemia may conceivably result not only from proteinuria, but also from decreased albumin synthesis, which is enhanced by thyroid hormones and cortisol [Fuhrman, 2002]. Hypoalbuminemia reduces plasma oncotic pressure, transferring intravascular fluid into the extravascular compartment, thereby reducing arterial volume and pressure [Soni and Margarson, 2004] – another mechanism that may further impair hemodynamics in BD/BSD patients.

Overt proteinuria is associated with elevated levels of serum ferritin that cannot be explained as an acute phase response; clinical data suggest that such an increased production of ferritin in proteinuric patients may rather compensate for the urinary loss of the iron-binding protein transferrin to reduce the excess of free iron concentration capable of causing oxidative damage to body tissues [Branten et al, 2004].

Ceruloplasmin is an essential ferroxidase that contains greater than 95% of the copper present in plasma [Madsen and Gitlin, 2007]. Like transferrin, ceruloplasmin is lost in urine in proteinuric states [Trip et al,

1968], and the consequences of ceruloplasmin and copper losses include free iron overload of brain parenchyma, anemia, diabetes, and neuronal death fundamentally due to lipid peroxidation [Madsen and Gitlin, 2007]. The anemia of low ceruloplasmin levels and/or copper deficiency is usually associated with a reduced reticulocyte count, neutropenia and thrombocytopenia [Zidar et al, 1977; Williams, 1983; Danks, 1988].
Hypothyroidism also causes anemia [Leithold et al, 1958], and thrombocytopenia [Bowles et al, 2004].

Progressive iron overload is a potential risk of blood transfusion in anemia caused by untreated hypothyroidism. Each unit of blood results in approximately 230 mg iron being added to a basal total body iron of three to five grams [Conrad et al, 1999]. Failure to recognize the pathophysiological importance of hypothyroidism in the setting of anemia associated with severe brain damage (as occurred with BBA during the first weeks or her treatment) leads to repeated blood transfusions to avoid life-threatening severe anemia, producing further iron overload, enhanced peroxidative damage of all tissues – including the brain, red blood cells and kidney. Peroxidation promotes cross links in membrane lipids, creating dysfunctional phospholipids. This is particularly problematic for anucleated cells like erythrocytes and platelets, which cannot repair membrane damage. These cells acquire stiffened, altered shapes, undergoing early destruction, thereby shortening the interval between transfusions and accelerating iron overload.

Peroxidation of membrane lipids by increased levels of free iron may lead to further glomerular damage and augment proteinuria, aggravating the urinary loss of transferrin, ceruloplasmin and hormone-bound proteins. Consequently, iron metabolism is further disturbed, causing more oxidative damage to blood-brain barrier and brain parenchyma (hypothalamus included), with further impairment of neuroendocrine function – a self-perpetuating vicious cycle of multiple tissue damage that cannot be reversed by the conventional therapies (such as barbiturate coma) currently regarded as “maximal treatment.” Plausibly, the rebound of brain edema and intracranial hypertension occasionally seen in some

victims of stroke or TBI during re-warming from therapeutic hypothermia [Jian et al, 2003; McIntyre et al, 2003; Olsen et al, 2003; Adelson et al, 2005] may be due to unrecognized (untreated) secondary hypothyroidism.

Respiratory failure due to "neurogenic" pulmonary edema is an underdiagnosed potential complication of severe brain insults such as intracranial hemorrhage and head trauma; the underlying mechanisms may involve a permeability defect without a vascular insult [Bowers et al, 1979; Colice et al, 1984; Dettbarn and Davidson, 1989; McClellan et al, 1989; Pender and Pollack, 1992; Pyeron, 2001; Fletcher and Atkinson, 2003], which conceivably may be due to central hypothyroidism and lipid peroxidation dependent on altered iron metabolism.

GH deficiency is the first and most common pituitary defect to appear after TBI [Popovic, 2005]. Binding sites specific for growth hormone have been identified in the brain but the action of GH on the CNS is still poorly understood [Burman et al, 1996]. GH crosses the blood-brain barrier and influences cognitive function, mood, memory, and sleep in humans [Nyberg, 2000; Burman et al 1995]. GH replacement affects cerebrospinal fluid (CSF) concentrations of some brain neurotransmitters and thyroid hormones in GH deficiency acquired in adult life [Burman et al, 1996], and GH increases peripheral conversion of T4 to T3 [Portes et al, 2000], indicating that GH and thyroid hormones interact cooperatively. In addition, GH replacement therapy in hypopituitary adults is associated with sodium and water retention [Weaver et al, 1994]. Therefore, GH deficiency may further aggravate hypotension in TSH and ACTH deficiencies associated with severe brain damage, thereby contributing to the vicious cycle where multiple hormonal deficiencies secondary to an early established impairment of hypothalamic-pituitary axes lead to refractory hypotension, and the resulting fall of brain perfusion pressure further damages the hypothalamus and other brain structures. The lack of a direct protective action dependent on GH can also play a role: similarly to thyroid hormones, GH also can exert neuroprotective actions, as demonstrated in animal models of spinal cord injury [Hanci et al, 1994; Winkler et al, 2000], and hypoxic ischemia [Gustafson et al, 1999].

Similarly, several neurotrophic and neuroprotective actions of estrogen in the brain have been discovered in recent decades, indicating that the reduced production of gonadotrophins may also significantly contribute to an unfavorable outcome in severely brain damaged patients. Estrogen neuroprotection is proposed to be mediated by genomic, nongenomic and anti-inflammatory mechanisms. Both direct effects on neurons and indirect effects mediated via astrocytes, endothelial cells and microglia are suggested to contribute to the overall protective actions of estrogen in the brain [reviewed by Brann et al, 2007].

Clearly, untreated hypopituitarism may decisively compromise the outcome of brain damage, and, conversely, early hormone replacement may induce brain reanimation and recovery of the injured hypothalamus and hypophysis, with consequent resumption of neuro-endocrine function. In other words, unrecognized impairment of the integrative hypothalamic and hypophyseal functions in brain injured patients may lead to disintegration of the organism as a whole. Also, timely hormonal replacement may compensate for that integrative impairment, dissipate the detrimental effects of endocrine failure on neuronal survival, and re- establish hormone-dependent repairing mechanisms of the nervous tissue, ultimately enabling neurological and neuro-endocrine recovery and self- sustained re-integration of the whole organism.

Further, current diagnostic criteria for BD/DSD do not differentiate absent from visually undetectable respiratory reflex, and have confounded this and other neurological functions that may be only reversibly suppressed (by ischemic penumbra and neuro-endocrine dysfunction) with those which are indeed irreversibly lost due to necrosis of brain tissue. As in many other medical conditions characterized in the past by a limited survival, the BD/BSD syndrome may prove to be clinically and neurologically recoverable in many patients who indeed receive timely and optimal treatment, based on solid and updated pathophysiological knowledge.

Unfortunately, the relevance of neuro-endocrine impairment for the recovery of the critically ill (including deeply comatose patients) has only been emphasized in recent years, and most of the medical community is still unaware of their implications [Popovic et al, 2005a; Popovic et al, 2005b; Marik, 2006]. Therefore, meeting the current criteria for the diagnosis of BD/DSD may not identify the "point of no return" and maximal treatment has actually not been provided to victims of brain damage, either to prevent imminent cardiac arrest or to enable neurological recovery. Claiming that early diagnosis of brain death is "certainly mandatory in order to save suitable organs" [Van Velthoven and Calliauw, 1988] is in conflict with knowledge of endocrine impairment developing within hours of brain injury [Woolf et al, 1988] (and demanding early therapeutic hormone replacement to avoid irreversible brain damage) [Tenedieva et al, 2000], and with the recognition of neuro-endocrine dysfunction as a confounding factor for the diagnosis of BD/BSD [Wijdicks, 1995; Wijdicks, 2001].

Uncontrolled brain edema resulting from conditions like TBI, ischemia or hemorrhage has been long recognized to exhaust intracranial volume compliance, leading to raised intracranial pressure, brain ischemia, brain herniation and death [Mayer et al, 1999]. The principal component is the vasogenic type of brain edema – where an increased vascular permeability leads to extravasation of serum proteins and retention of water in the extracellular space of the brain tissue [Klatzo, 1987]. Notably, the importance of tractable neuroendocrine disturbances such as secondary hypothyroidism (known to cause similar vascular permeability changes) for the aggravation of brain edema has not been considered in studies on this issue, nor even in the most recent reviews, where the therapeutic progress is acknowledged as unsatisfactory [Marmarou, 2007; Zador et al, 2007]. Death is irreconcilable with reversibility, and the word "dead" applied to these patients for their legal characterization as organ donors has veiled the therapeutic perspectives related to pathophysiological mechanisms of the BD/BSD syndromes to medical investigation. Consequently, the medical community has

regarded neuroendocrine disturbances as simple signs of "disintegration of the organism as a whole" rather than disorders requiring prompt recognition and hormonal replacement therapy to avoid irreversibility, promote recovery from brain damage and resumption of self-sustained neuro-endocrine and neurologic functions.

Other therapeutic measures critical for neurological recovery

In order to satisfactorily change the outcome for victims of severe brain damage, novel concepts related to the pathophysiology of neuronal death have to be urgently understood by the neuro-intensivist because they usually imply the adoption of simple, effective and harmless therapeutic approaches that have been unraveled by well designed preclinical research during the last few years or decades. Some of them have already been preliminarily confirmed in pilot open label clinical studies. Unfortunately, they have not been taken into consideration in medical textbooks. Not making therapeutic resources available to victims of severe brain damage under the excuse that they require "multicentric, double-blind randomized studies" to be acceptable is senseless and unethical, particularly because no other efficient alternative is offered. In a large number of hospital centers, particularly in those involved in the transplantation system, mere supportive measures to maintain vital signs consume the critical time-window for effective treatment that could avoid neuronal death and promote neurological recovery – as occurred with BBA following her first hospital admission. Frequently, not even current therapeutic guidelines to avoid severe secondary damage are followed.

Nevertheless when deep coma eventually ensues, these patients are customarily submitted to "diagnostic" protocols that include the apnea test – the morbidity and lethality of which has been consistently documented [Bar-Joseph et al, 1998; Marks and Zisfein, 1990; Jeret and Benjamin, 1994; Zisfein and Marks, 1999; Goudreau et al 2000; Saposnik et al 2000; Saposnik et al 2004]. The ethical inconsistency of this common practice becomes evident by reading the paragraph # 32 of the

declaration of Helsinki from the World Medical Association web site (http://www.wma.net/e/policy/b3.htm):

"In the treatment of a patient, where proven prophylactic, diagnostic and therapeutic methods do not exist or have been ineffective, the physician, with informed consent from the patient, must be free to use unproven or new prophylactic, diagnostic and therapeutic measures, if in the physician's judgment it offers hope of saving life, re-establishing health or alleviating suffering. Where possible, these measures should be made the object of research, designed to evaluate their safety and efficacy. In all cases, new information should be recorded and, where appropriate, published."

Victims of severe brain damage customarily do not receive even well established (officially recommended) therapy

Antipyresis is an eloquent example of these most valuable but frequently ignored therapeutic measures. In 1974 Clasen and co-workers demonstrated that only two hours of hyperthermia increases vasogenic brain edema by 40%, *implying a rapid progression to BD/BSD syndrome in victims of severe brain damage with uncontrolled hyperthermia*. Since their experimental work, a large number of clinical and experimental data have indicated that hyperthermia is associated with devastating effects in different types of brain damage. Hyperthermia in the acute post-injury phase (either caused by hypothalamic dysfunction or complicating infections) is a major factor associated with increased intracranial pressure and worsened outcome (including higher mortality rate and more severe neurological sequelae) after TBI [Sazbon and Groswasser, 1990; Dietrich, 1992; Dietrich et al, 1996; Heindl and Laub, 1996; Behr et al, 1997; Chatzipanteli et al, 2000; Natale et al, 2000; Jiang et al, 2002; Stocchetti et al, 2002; Diringer et al, 2004], brain hemorrhage [Weir et al, 1989; Schwarz et al, 2000; Kumral et al, 2001; Oliveira-Filho et al, 2001; Fernandez et al, 2007] and ischemia [Hindfelt, 1976; Azzimondi et al, 1995; Coimbra et al, 1996a; Reith et al, 1996; Castillo et al, 1998;

Ginsberg and Busto, 1998; Keysera, 1998; Grau et al, 1999; Kumral et al, 2001].

The detrimental mechanisms enhanced by hyperthermia may be related to the cytotoxic events that occur in the marginally perfused, nonfunctional but viable and potentially salvageable tissue, either the focal (peri-infarct) [Keysera, 1998] or global [Coimbra, 1999] penumbra. Hyperthermia may be associated with increased excitatory amino acid release and free radical production, enhanced cytoskeleton proteolysis/lipolysis, increased vasogenic edema, increased intracranial pressure, and increased metabolic expenditure, ultimately resulting in increased neuronal demise [Flanagan et al 1998; Ginsberg and Busto, 1998; Thompson et al, 2003]. Therefore, the hyperthermia-related increase of intracranial pressure predictably further impairs brain circulation, turning ischemic penumbra into necrosis. Although there have been no controlled studies, the existing evidence is sufficiently compelling to indicate that even slightly raised body temperature should be combated continuously in acute stroke and trauma patients, even if "minor" in degree and even when delayed in onset [Ginsberg and Busto, 1998; Keysera, 1998]. A controlled trial of comparing treatment with no treatment of fever would be unethical [Keysera, 1998]. Hyperthermia is extremely frequent in the acute phase after head injury [Kilpatrick et al, 2000; Stocchetti et al, 2002; Childs et al, 2005]. In the study by Childs et al [2005] more than 80% of critically ill TBI patients experienced brain temperatures over 38 °C in the first 3 days following injury.

Accordingly, antipyresis has been repeatedly included in the guidelines for the treatment of intracranial hypertension since 1996 [Brain Trauma Foundation/American Association of Neurologic Surgeons, 1996; Brain Trauma Foundation/American Association of Neurologic Surgeons, 2000; Selden et al, 2003; Johnston et al, 2006]. However a recent study on a population of critically ill patients with TBI demonstrated that in only 31% of events did the patient receive any documented intervention for the elevated temperature [Thompson et al, 2007]. In the study by

Kilpatrick et al [2000], 57% of the febrile episodes, although treated with antipyretics, lasted longer than 4 hours, and 5% lasted longer than 12 hours.

This situation has virtually not changed from the time prior to the inclusion of antipyresis in official therapeutic guidelines. A retrospective review of the medical records of patients admitted to Mayo Clinic, in Rochester (USA), between January 1991 and December 1994, comprising victims of out-of-hospital cardiac arrest (CA), subarachnoid hemorrhage (SAH), or traumatic closed-head injury (CHI) revealed that temperature increases to 38 degrees C or more were noted in 83% of patients with CA, 70% of those with SAH, and 68% of those with CHI during the initial 72 hours of hospitalization. Fewer than one-eighth of the febrile patients received antipyretic medications in doses appropriate to treat fever and none were treated by other method of temperature control (for example, physical means) [Albrecht et al, 1998].

Considering the rapid and vigorous enhancement of brain edema and increase of intracranial pressure provoked by hyperthermia, the higher mortality rate associated with elevated body and brain temperature in patients with severe brain damage is predictably due do BD/BSD diagnosis. Therefore, nowadays many brain-injured patients conceivably evolve to deep coma and are submitted to diagnostic protocols for BD/BSD without having even received the current standard of basic care to prevent further brain injury from secondary insults. The action of otherwise neuroprotective drugs in brain damage may be nullified by mild hyperthermia [Ginsberg and Busto, 1998]. Again, "maximal treatment" has actually not been provided to victims of severe brain damage while they relentlessly progress to deep coma and cephalic areflexia and are then submitted to the lethal "diagnostic" procedures for BD/BSD. After declaration of BD/BSD, fever may continue, sustaining hyperthermia- enhanced neurodegenerative mechanisms that eventually turn neurological recovery impossible.

A surge of regenerative metabolic activity following brain damage generates a high demand for specific nutrients at the injured site, which has to be meet immediately to enable recovery

Proper valuation of novel, harmless and potentially highly effective neuroprotective approaches requires a brief update of recent advances in the pathophysiology and reversibility of brain damage. A series of experiments conducted by different groups in the 1990's revealed that moderate hypothermia of sufficient duration, even when induced several hours from a transient lethal ischemic insult to the rodent brain, is capable of rescuing a large percentage of neurons from death [Coimbra and Wieloch, 1992; Coimbra and Wieloch, 1994; Coimbra et al, 1996b Colbourne and Corbett, 1994; Colbourne and Corbett, 1995; Colbourne et al, 1997; Colbourne et al, 1999]. This effect is no longer observed when a period of hyperthermia follows the hypothermic treatment [Coimbra et al, 1996b]. Regardless of which pathophysiological mechanisms are sensitive to temperature in the post-ischemic period, a major contribution from those studies on post-ischemic hypothermia is the perception that ischemic neuronal death is a relatively slow process that remains reversible for several hours from recirculation. As global ischemia is the fundamental phenomenon inherent to major intracranial hypertension, in conditions such as TBI, intracranial hemorrhage and space occupying ischemic stroke, the nervous tissue may remain recoverable for several hours following global ischemic penumbra [Coimbra, 1999] or complete ischemia if the injured tissue is recirculated on a timely basis, and immediately offered adequate amounts of nutraceuticals required for regenerative activity, provided that reactive oxygen species (ROS) are efficiently neutralized.

The neuronal damage induced by brain ischemia (including impaired cerebral circulation caused by intracranial hypertension) is determined by the damaging effect of ROS – most of which are paradoxically produced at the time of recirculation, when the oxygen supply required for the production of these reactive species is restored (reperfusion injury) [Love, 1999]. ROS injure nuclear DNA (nDNA), mitochondrial DNA (mtDNA), proteins and membrane lipids [Abe et al, 1993; Chan, 1996; Szabó, 1996; Love, 1999].

In part because of the spatial proximity of mtDNA to the electron transport system, where oxidative phosphorylation occurs with the concomitant generation of ROS [Liu et al, 2002], the probability of oxidative damage to mtDNA is several times higher than nuclear DNA [Richter, 1995]. Specific patterns of mtDNA deletions occur in transient global ischemia, TBI, and focal ischemia [McDonald et al, 1999; Zeng et al, 1999]. DNA repair is essential for neuronal survival [Weissman et al, 2007; Wilson and McNeill, 2007]. During the first 24 to 48 hours of recirculation, the neuronal cells struggle for survival by repairing and replicating mtDNA [Abe et al, 1996; Chen et al, 2001; Chen et al, 2003] and repairing nDNA [Liu et al, 1996; Nagayama et al, 2000a; Nagayama et al, 2000b; Lan et al, 2003]. Other critical regenerative phenomena concomitantly take place, including the reduction of oxidized membrane lipids [Baek et al, 2007], re-synthesis of phospholipids [Rao et al, 1999] and, through the action of heat shock proteins (HSP) [Sherman and Goldberg, 2001; Christians et al, 2002], degradation and re-synthesis of irreversibly damaged proteins (the transcription process coupled with mtDNA replication) [Taanman, 1999], and re-fold of recoverable peptide chains to their tertiary/quaternary (active) structures [Christians et al, 2002].

The ultimate outcome (survival) of the post-ischemic neuron critically depends on the availability of nutrients required for these vital regenerative intracellular biochemical reactions. These have to occur imperatively within a relatively narrow time-window to avoid the demise of neuronal cells. For instance, oxidative stress cause single-strand breaks in DNA, which activate the DNA repair protein poly(ADP-ribose) polymerase (PARP). This catalyzes the cleavage and thereby the consumption of NADH, the source of energy for many vital cellular processes. NADH and NADPH are the active forms of vitamin B3 (nicotinamide) which is involved in more than 500 biochemical reactions, including supplying protons for oxidative phosphorylation (mitochondrial respiration), glycolysis or lipid β-oxidation [Depeint et al, 2006a]. Over-activation of PARP, with resulting depletion of NAD, has been shown to be associated with brain damage after transient focal ischemia in experimental animals; neuronal accumulation of poly(ADP-ribose), the

end-product of PARP activity has been demonstrated after brain ischemia in man [Love, 1999]. Accordingly, a single high dose of nicotinamide administered 2 hours after transient or permanent focal cerebral ischemia reduces infarct volume in rodents [Mokudai et al, 2000; Yang et al 2002; Sakakibara et al, 2002]. Delayed multidose treatment with nicotinamide provides further protection [Maynard et al, 2001]. This suggests that the availability of nicotinamide at the injured site of the brain is a limiting step for DNA repair and cell survival, powerfully influencing the outcome of the penumbra zone. Similar effects were demonstrated in TBI models [Hoane et al, 2003; Hoane et al, 2006a, Hoane et al, 2006b]. Other mechanisms, reviewed by Maiese and Chong [2003], may be involved in the neuroprotective effect provided by nicotinamide.

Likewise, a number of data indicate that a high consumption of riboflavin (vitamin B2) active metabolites (FAD and FMN) must occur at sites of CNS damage due to intense anti-oxidant activity and up-regulated regenerative reactions. For instance, FAD is required for the synthesis of heme which integrates the mitochondrial electron-transport chain, and the replenishing of mitochondrial complexes following re-synthesis or repair of ROS-damaged mtDNA requires heme production. In addition, FMN integrates the structure of Complex I [Nelson and Cox, 2004], and FAD- dependent dehydrogenases are responsible for the mitochondrial oxidation of succinate, glycerophosphate, β-hydroxybutyrate, ketoglutarate, glutamate, pyruvate and malate [Depeint et al, 2006a]. Low activity of these enzymes may compromise Krebs cycle and ATP production. Glutathione is a small tripeptide that exists in the reduced (GSH) and the oxidized (GSSG) forms, and the cycling between GSH and GSSG serves to remove ROS. GSSG reductase (GR) requires FAD as a prosthetic group to regenerate GSH, and GSH is used by GSH peroxidase (GPx) to eliminate H_2O_2 and other peroxides (ROS) [Jones, 2002]. Either FAD or GSH is necessary for deoxyribonucleotide synthesis [Nelson and Cox, 2004], increasing the demand for vitamin B2 at the site or CNS damage for nuclear and mtDNA synthesis and repair.

The anti-oxidant effects of vitamin B2 have been documented in diverse studies [Christensen, 1993; Hultquist et al, 1993; Mack et al, 1995; Seekamp et al, 1999]. Accordingly, the administration of high doses of riboflavin in the acute phase of TBI reduces lesion size, edema formation and gliosis, while improving the functional outcome in rats [Hoane et al, 2005; Barbre and Hoane, 2006]. Similar results were observed in experimental focal brain ischemia [Betz et al, 1994]. The mechanism proposed for the beneficial effect of vitamin B2 is the NADPH-dependent enzymatic conversion of riboflavin to dihydroriboflavin. Dihydroriboflavin reacts rapidly with Fe(IV)O and Fe(V)O oxidation states of hemeproteins, states that have been implicated in tissue damage associated with ischemia and reperfusion [Hultquist et al, 1993].

Other mechanisms potentially involved in the benefit of high-dose riboflavin administration are related to improved mitochondrial function, reducing the formation of $O_2^{\bullet -}$ and increasing ATP production from the oxidative phosphorylation, and elimination of H_2O_2 via GPx, ultimately preventing further production of the highly reactive hydroxyl radical [Yang et al, 2006]. Like GPx, the activity of phospholipid hydroperoxide glutathione peroxidase (PHGPx – an ubiquitous antioxidant enzyme and the only one known capable of reducing lipid peroxides bound to cell membranes) [Cejas et al, 2007] also result in GSSG production (GSH oxidation), and therefore cannot be sustained without the reconstitution of GSH (GSSG reduction) by FAD-dependent GR. GSH, in turn, plays important roles in regulation of cellular events (including gene expression, DNA and protein synthesis, cell proliferation and apoptosis, signal transduction, cytokine production and immune response, and protein glutathionylation) [Hall, 1999; Wu et al, 2004].

The administration of high doses of riboflavin may be particularly relevant to a considerably large number of individuals who have low vitamin B2 status prior to the event causing CNS damage. Anderson et al [1994] estimated that 10-15% of the world population is riboflavin

deficient due to an inherited alteration of mechanism of absorption for this micronutrient. Thus, the administration of high doses of riboflavin (30-60 mg every 6 to 8 hours via feeding tube) to victims of brain damage may provide a fundamental neuroprotective effect [Coimbra and Junqueira, 2003]. Therefore, uncorrected riboflavin deficiency, either caused by impaired intestinal absorption and by increased local demand due to oxidative tissue damage may unfavorably influence recovery from brain damage.

In addition to vitamins B2 and B3, the surge of regenerative phenomena during the initial post-injury period to achieve neuronal cell survival seems to require high doses of other essential nutrients (nutraceuticals). Choline is formed from tri-methylation of ethanolamine, which in turn is produced by decarboxylation of serine. Choline is an important nutrient for the normal function of all cells, and in 1998 the Institute of Nutrition of the National Academy of Science of USA concluded that dietary choline is essential for humans [Institute of Medicine, 1998]. Choline is the major source of methyl groups in the diet, as well as a major component of phospholipids and a precursor of the neurotransmitter acetylcholine (Zeisel and Blusztajn, 1994). Reduced methylation impairs DNA synthesis and repair, and protein synthesis [Depeint et al, 20006b; Niculescu and Zeisel, 2002]. Choline deficiency induces neuronal death (apoptosis) both in vitro and in whole animals [Holmes-McNary et al, 1997; Yen et al, 2001]. A decreased ability to resynthesize membrane phospholipids (as expected in choline deficiency caused by peroxidation of choline-containing phospholipids) [Scremin and Jenden, 1991] can lead to further generation of free radicals, excitotoxicity, mitochondrial dysfunction, and neuronal death (apoptosis/necrosis) in ischemic, traumatic, and neurodegenerative disorders [Kuhmonen et al, 1994; Nakane et al, 2000; Phillis and O'Regan, 2004]. Accordingly, the administration of CDP-choline (citicoline) enhances the phospholipid synthesis and phospholipid incorporation into cell membranes [Siegel et al, 1979; Knapp and Wurtman, 1999; Adibhatla et al, 2001], and the administration of citicoline has been demonstrated to be powerfully neuroprotective by

diverse studies in experimental brain ischemia and clinical ischemic stroke [Tazaki et al, 1988; Clark et al, 1997; Clark et al, 1999; Warach et al, 2000; Davalos et al, 2002, Hurtado et al, 2005]. Some authors have proposed that "in humans, citicoline is the only neuroprotectant that has shown positive results in all randomized, double-blind trials and has demonstrated efficacy in a meta-analysis with an overall safety similar to placebo" [Davalos et al, 2002; Hurtado et al, 2005]. Conceivably the protective effect of citicoline may be due to the presence of choline, as choline (but not CDP) is an essential nutrient, and the post-ischemic administration of choline alone provided powerful neuroprotective effect in a rodent model of transient global ischemia (Borges et a, 2007).

Similarly to betaine (synthesized from choline), other micronutrients required for the production of S-adenosylmethionine for methylation reactions (which take part in DNA, protein and phospholipids synthesis) such as pyridoxal 5'-phosphate (PLP – the vitamin B6 active form), folic acid, riboflavin and cobalamin [Bottiglieri et al, 1994; Depeint et al, 2006b], may act as neuroprotective nutraceuticals in brain damaged patients. Accordingly, PLP was shown to be neuroprotective in a rodent of transient ischemia [Hwang et al, 2007], while folate deficiency causes uracil misincorporation into DNA and chromosomal breakage, impairs base excision repair, and increases post-ischemic brain injury [Endres et al, 2005].

Glutamine is the most abundant free amino acid in the body. In addition to being a precursor for protein synthesis, glutamine serves as a nitrogen source for the synthesis of arginine, purines, pyrimidines, nucleotides, and glutathione. Thus, cells requiring rapid protein, glutathione and nucleic acid synthesis are highly dependent on glutamine. In normal circumstances, glutamine is not an essential amino acid.

However, under catabolic stress conditions and/or proteinuria, endogenous production cannot keep up with increasing demands, and glutamine becomes an essential amino acid. Glutamine depletion affects cell proliferation and weakens the gastrointestinal barrier and immune system functions, increasing mortality in critically ill patients. The benefits of increased glutamine are numerous. High-dose glutamine supplementation reduces infection rate and inflammation, sepsis,

mortality, hospital stay, and hospital costs, and promotes protein synthesis (enhancing the synthesis of HSP) and wound healing in critically ill patients [reviewed by Ali and Roberts, 2006], including TBI victims [Falcão de Arruda and de Aguilar-Nascimento, 2004; Yang et al, 2007].

Some sulphur-containing enzymes (GSSG reductase, GHS peroxidase, superoxide dismutase, and catalase) and proteins (ceruloplasmin, transferrin, albumin, and heparin) are free radical scavengers protecting against ROS. Thus, in addition to their nutritional value, the S-containing nutraceuticals (Taurine and N-acetyl cysteine) may also act as antioxidants with pharmacologic applications or as precursors to antioxidant peptides (GSH and other thiols) [Atmaca, 2004]. Accordingly, N-Acetyl cysteine protects the nervous tissue against experimental ischemia [Sekhon et al, 2003], and taurine is neuroprotective in many cell-damaging conditions including oxidants, excitatory amino acids, hypoxia, and ischemic insults [Saransaari and Oja, 2000; Wang et al, 2007].

CNS traumatic or ischemic injury induces an acute inflammatory reaction, composed mainly of invading leukocytes and activated microglial cells/macrophages, leading to sustained production of ROS and secondary brain damage. These inflammatory phenomena may last for weeks or months, makes a significant contribution to the neurological deterioration witnessed in patients [Beschorner et al, 2002; Rahman et al, 2005; Zhang et al, 2006], and represent an ideal target to exploit for therapeutic interventions, as their effects can potentially be halted within a clinically relevant therapeutic window. Contrastingly, when its activity is properly modulated, resident microglia may provide beneficial effects to the damaged CNS [Simard and Rivest, 2007]. Vitamin D has several trophic effects in the CNS [for a review, see Garcion et al, 2002], and seems to be a valuable tool to turn microglial reaction into part of the regenerative processes in the damaged brain.

In the CNS, activated microglia can locally perform the biosynthesis of the active form of vitamin D3 (calcitriol) from its precursor. Glial

(including microglial) and neuronal cells are local targets for calcitriol. In astrocytes, calcitriol upregulates the synthesis of several neurotrophins, including NGF, NT3 and GDNF, and of γ-glutamyl-transpeptidase, which could be involved in the neuroprotective effects of vitamin D. Intraneuronal GSH, provided from extracellular GSH by serial enzymatic steps involving astrocytic γ-GT, could then be used to prevent the formation of reactive nitrogen or oxygen radicals in these cells Inhibition of the synthesis of inducible (inflammatory) nitric oxide (NO) synthase (iNOS) in microglia by calcitriol (an autocrine effect) is another way to mediate the neuroprotective effects of vitamin D. Large amounts of NO produced by iNOS are toxic for both neurons and oligodendrocytes (the CNS-myelinating cells). NO can rapidly react with oxygen species to form highly harmful products such as hydroxyl and nitrogen dioxide radicals [Beckman et al, 1990; Garcion et al, 2002]. Accordingly, calcitriol provided protection to the penumbra zone in a rodent model of permanent focal ischemia [Wang et al, 2000].

Cumulating evidence has indicated that inadequate sunlight exposure typical of urban life leads to vitamin D deficiency, and that current recommended daily allowance (RDA) is lower than necessary for achieving all the desirable effects of vitamin D on human health [Vieth, 2004]. The current adult RDA for vitamin D, 200-600 IU/d, is very inadequate when one considers that a 10-15 min whole-body exposure to peak summer sun will generate and release up to 20,000 IU vitamin D-3 (cholecalciferol) into the circulation [Hollis, 2005]. Non-human primates are at or beyond the top of what we currently regard as the "normal" range for humans – the circulating values of modern adults being closer to concentrations found in laboratory rodents [Vieth, 2004].
Hypovitaminosis D is more common in general medical inpatients, including those with vitamin D intakes exceeding RDA and those without apparent risk factors for vitamin D deficiency [Thomas et al, 1998].
Thyroid hormone and vitamin D may act cooperatively to determine trophic effects on tissues [Galeeva et al, 2002]. Therefore the administration of cholecalciferol (the inactive form of vitamin D) at physiologically realistic doses (20,000 IU per day in adults, with daily

monitoring of total and free serum calcium levels) enables the CNS production of calcitriol, which may down regulate the inflammatory (detrimental) reactions and up regulate trophic and regenerative phenomena in the acute and chronic phases of brain damage.

Many clinical studies suggest that omega-3 polyunsaturated fatty acids such as eicosapentaenoic acid and docosahexaenoic acid have beneficial actions in human diseases. The molecular basis of these actions remains of interest. Recent findings demonstrate that eicosapentaenoic acid and docosahexaenoic acid are precursors to potent (nM range) bioactive mediators that possess both anti-inflammatory and neuroprotective properties: these were coined resolvins, docosatrienes, protectins and neuroprotectins [Serhan, 2005]. Overall, omega-3 fatty acids emerge as powerful nutrients with pharmacologic properties potentially improving prognosis in critically ill patients [Hasselmann and Reimund, 2004; Ali and Roberts, 2006; Mayer et al, 2006].

Even after re-establishment of spontaneous respiration and initial recovery from coma, the administration of generous doses of nutraceuticals should be maintained probably for months to enable effective neurite growth, synaptogenesis, neurogenesis and maximal neurological recovery. Neurite growth followed by synaptogenesis in the adult brain provides neuroanatomical remodeling for recovery of function [Stroemer et al, 1995]. Adult neurogenesis may also be relevant, in the long run, to the development of therapeutic strategies for the treatment of brain damage [Gross, 2000]. Under no therapeutic intervention subventricular zone neuroblasts emigrate toward brain injury but relatively few survive [Sundholm-Peters et al, 2005; Dizon et al, 2006]. Neurons that do not succeed in establishing functional synaptic connections are eliminated by apoptosis [Oppenheim, 1991]. Thus, failure to provide adequate amounts of co-enzymes and substrates for optimal stem-cell proliferation, emigration of newborn neuroblasts, neural sprouting, neurite growth and synaptogenesis may conceivably limit neurological recovery in the long run. Similarly, neurogenesis is not expected to contribute to clinical improvement if the general brain

structure is not preserved by timely and vigorous antipyresis, effective anti-oxidant and anti-inflammatory therapy, particularly during the acute phase of brain damage.

Dimethyl sulphoxide (DMSO) may promote reperfusion of the brain tissue under global ischemic penumbra and effectively neutralize hydroxyl radicals, minimizing the oxidative injury to the brain during reperfusion and enabling the post-ischemic surge of regenerative processes

Proper validation of potentially effective therapies requires a reasonable knowledge of lipid *peroxidation* – the biochemical phenomenon underlying the development of brain edema, intra-cranial hypertension, compression of the brain microvasculature, and ischemic neuronal death (necrosis or apoptosis) following a number of different causes of brain damage [Hall, 1989; Braughler and Hall, 1992]. Suffice to say that such expression is hardly ever mentioned in the chapters of medical textbooks dealing with the treatment of different modalities of brain damage. Contrastingly, that expression integrates the *title* of nearly 12,000 articles published to date in indexed medical journals and, in 1,840 of them, the article's subject is the damage to the nervous system (source: scirus.com).

Lipid peroxidation is a chain reaction in which one free radical can induce the oxidation of a large number of lipid molecules – mainly phospholipids containing polyunsaturated fatty acids (PUFA) [Porter, 1984]. The consequence is loss of selective permeability of cell membranes, leading to vasogenic and/or cytotoxic edemas, respectively when the cells of the blood-brain barrier and/or the neural cells are affected. [Klatzo, 1987]. Lipid peroxidation occurs early after severe TBI in adults [Bayir et al, 2004]. Therefore, an early, vigorous and efficient combat to lipid peroxidation and its consequences (brain edema and elevated ICP) may prevent or limit the development of a major, long- standing or irreversible hypothalamic damage and the related vicious

cycle related to impaired pituitary function, thereby enabling neurological recovery and survival following a number of coma-associated conditions.

Among the ROS, the hydroxyl radical – produced by the combined effect of Fenton and Haber-Weiss reactions – is so powerfully reactive against organic molecules that no enzyme system exists to neutralize it. Consequently, the fundamental pathophysiological role of the hydroxyl radical in inflammation, peroxidative tissue damage and cell demise in a variety of human diseases has been widely acknowledged [Tauber and Babior, 1977; Willmore and Rubin, 1984; Halliwell and Chirico, 1993; Lubec, 1996], while the low bioavailability and limited potency of the conventional antioxidant therapy have become apparent [Willmore and Rubin, 1984; MacNee, 2001]. Accordingly, effective therapeutic approaches should aim at both effectively neutralizing already formed hydroxyl anions and preventing further production of this highly reactive free radical.

DMSO is highly reactive with hydroxyl radicals, forming dimethyl sulfone and water which are then readily excreted from the body [Kocsis et al, 1975; Jacob and Herschler, 1986]. Accordingly, a single administration of DMSO 30 min before the exposure to a strong peroxidative insult (gamma-ray whole body irradiation) significantly decreases the hepatic tissue concentration of lipid peroxides [Ueda et al, 1993]. The prompt inter-conversion between the two (polar and non- polar) resonance structures of DMSO, as well as the conservation of two non-polar domains in the polar structure [Santos et al, 2003], seem responsible for the high solubility of this molecule in either hydrophilic or lipophilic media. This notable amphyphatic feature explains the remarkable ability of this molecule to penetrate nearly all body tissues (except enamel of teeth, fingernails and hair), being readily absorbed when administered topically or orally ingested [Jacob and Herschler, 1986].

The diverse array of proposed therapeutic benefits reported since the 1960's [Swanson, 1985; Jacob and Herschler, 1986; Santos et al, 2003] may have negatively affected the reputation of DMSO in the medical

community, where the idea of a false panacea became initially unduly dominant. In addition, its original use as an industrial solvent has contributed to the high controversy regarding the potential toxicity of DMSO. However, the ability of DMSO to inactivate a nearly universal and powerful tissue damaging mediator – the hydroxyl radical – may explain at least in part the diversity of potential therapeutic applications proposed for this compound [Beilke et al, 1987]. DMSO was also found to quench the oxidant activity of hypochlorous acid produced by stimulated human neutrophils [Beilke et al, 1987]. In addition, numerous in vivo studies have demonstrated that this drug is non-toxic at relatively high concentrations [Ashwood-Smith, 1975] and intravesical administration of DMSO has been approved by the FDA for the treatment of interstitial cystitis following double blind human studies [Swanson, 1985; Parkin et al, 1997]. Taken together, these features (high penetration into tissues and organic fluids, low toxicity, and high specific reactivity towards the hydroxyl radical) make of DMSO an almost perfect hydroxyl radical scavenger [Jahnke, 1999].

The prompt diffusion of DMSO through the blood-brain barrier greatly increases its effectiveness in neutralizing hydroxyl anions in the CNS [McGraw, 1983]. Accordingly, DMSO has shown therapeutic effectiveness in CNS ischemic and traumatic damage – indicated by numerous animal and human studies [de la Torre et al, 1975; de la Torre et al, 1976; McGraw, 1977; Brown et al, 1980; Camp et al, 1981; Del Bigio et al, 1982; Tsuruda et al, 1982; McGraw, 1983; Tsuruda et al, 1983; Tung et al, 1983; Tung et al, 1986; Marshall et al, 1984; Willmore and Rubin, 1984; Anderson et al, 1985; Coles et al, 1986; Ikeda and Long, 1990; Kulah et al, 1990; Karaca et al, 1991; Shimizu et al, 1997; Lu and Mattson, 2001; Farkas et al, 2004; Farkas et al, 2005]. Early administration appears to be a requirement for maximum effectiveness [Anderson et al, 1985]. Due to its multiple known pharmacological properties, DMSO was emphasized as "really a new principle in medicine and cannot always be measured by existing standards" [Wood and Wood, 1975].

Karaca et al [1991] reported a pilot study on the effect of DMSO (1.12g.kg^{-1}, at 28% in physiological saline: 56:200 ml delivered intravenously at a fast drip rate every 6 hours) on 10 patients with closed head trauma with low GCS score (range from 3-9, average 6) and elevated intracranial pressure (ICP, range 40-127 mm Hg, mean 73 mmHg, normal 5-13 mm Hg). All patients showed a reduction of ICP after 24 hours and 7 had normal ICP after 6 days of treatment. The dose of DMSO was reduced by half when the ICP reached 20 mm Hg or lower, and was continued until ICP stabilized or full recovery observed. Two patients died, 2 had severe neurological deficits and 6 had mild or no deficit at the time of hospital discharge. After a 3 month follow up 1 patient remained with severe neurological impairment and 7 showed mild or no deficit. Although the lowering of ICP was dramatic, being seen in most cases within the first 30 min of DMSO administration, fluctuations occurred, requiring maintenance doses for 2-10 days. In contrast with patients treated with mannitol, no sudden rebound phenomena were seen, and CT scans confirmed the reduction in brain swelling following DMSO administration. The author's preliminary data suggest that early administered DMSO is effective in reducing ICP refractory to conventional therapy. Their results support previous observations [Waller et al, 1983; Marshall et al, 1984] and are consistent with a parallel study by Kulah et al [1990].

Diffuse axonal injury (DAI) occurs when the cerebrum goes into a back and forth sliding motion, pivoting around the upper brainstem. DAI is most severe along midline structures (corpus callosum, brainstem), and at the cortex-white matter junction. Clinically, patients with severe DAI become unconscious immediately after the injury and either remain comatose or go into a persistent vegetative state. Axons are stretched but do not snap from this sudden deformation. Secondary changes in the axonal cytoskeleton (compaction of neurofilaments, loss of microtubules) arrest the axoplasmic flow, and components of this flow accumulate proximal to the lesion causing axonal swellings located at nodes of Ranvier where the axolemma is more liable to deform due to the lack of myelin. Some axons with mild lesions probably recover but many

eventually rupture *several hours from trauma* [Matthews et al 1998]. The cascade of reactions leading to DAI is probably initiated by influx of calcium through the stretched axolemma, resulting in oxidative burst [Santos et al, 2005]. Since early administration of DMSO is an effective strategy for limiting axonal damage in spinal cord injury [Anderson et al, 1985], timely DMSO i.v. infusion at the accident scene may conceivably limit DAI and increase the chances of neurological recovery.

Conclusion

The answer to the title question of this chapter requires a brief summary on the changes of our knowledge of what BD/BSD really is. Accumulating evidence shows that the premises used to support the diagnostic protocols for BD in 1968 were never scientifically sound and must now be seen as outdated. Evidence which has become available in the past couple of decades completely undermines definitions of BD based on concepts of "total brain destruction," "total brain necrosis" or "total brain infarction" (meaning destruction of the whole brain tissue as a consequence of absent brain blood flow) - which were the conditions alleged to be diagnosed by the criteria introduced into medical practice for the diagnosis of death on neurological grounds in the late 1960's and early 1970's [Ingvar, 1971]. From the very beginning, brain necrosis was firmly accepted, as no other explanation except irreversible interruption of blood flow was considered plausibly to explain the absence of brain functions in a patient with severe intracranial hypertension. Absence of neural function was then considered to correlate invariably with loss of brain vitality (necrosis). This is a fundamental issue: necrosis indisputably implies unrecoverable brain functions despite "maximal therapy," and it was precisely that argument that determined the medical, legal, religious and philosophical acceptance of the redefinition of death as BD in 1968 [Giacomini, 1997], allowing physicians to interrupt life support and/or harvest transplantable organs ever since. A lack of electroencephalographic activity was then proposed to confirm BD.

Contrasting to that initial definition, it is now known that several brain functions that had been overlooked in the late 1960's do remain active in patients who, nevertheless, fulfill diagnostic criteria for BD/BSD that were established by then, and which have undergone only minor changes since. Among cases diagnosed with BD according to current guidelines there is a lack of diabetes insipidus in 50% (preserved hypothalamic function); sustained electroencephalographic activity, brainstem-evoked potential activity, brain blood flow, and a lack of pathologic destruction of brain (brain necrosis) in 5-20%; sometimes, even respiratory activity at a $PaCO_2$ >60 mm Hg [Joffe and Anton, 2006]. Even absence of respiratory activity has been a matter of debate. While most authors have affirmed that unresponsiveness to apnea testing is absolutely fundamental for the diagnosis of BD/BSD [American Academy of Neurology, 1995; Bar-Joseph et al, 1998; Vardis and Pollack, 1998, Saposnik et al, 2004], others have indicated that a minor or atypical responsiveness would not rule out the diagnosis of BD/BSD. For instance, Ropper et al [1981], during an apnea test in three patients, described "spontaneous respiratory-like movements" with "shoulder elevation and adduction, back arching, "slight intercostal expansion" and inspired volumes of 20-50 mL "ineffective for ventilation."

As a consequence, the concept and definition of BD/BSD has changed dramatically, and "total brain necrosis" has been replaced by "irreversible loss" of an arbitrarily selected specific set of brain functions. If sustained for a few hours, the absence of that particular set of functions would imply that the brain regions involved in carrying them out were destroyed – which would be consistent with the diagnosis of BD [Bernat, 1992]. However, the results of an apnea test reported by Vardis and Pollack [1998] demonstrate how arbitrary the current diagnostic parameters for BD/BSD are. A 4-year old boy (with a diagnosis of acute pilocytic astrocytoma and global cerebral hypoxic ischemic damage secondary to a cardiorespiratory arrest) initiated respiratory efforts with a pH of 7.08 and a $PaCO_2$ of 91 mmHg. Although the respiratory function was clearly not "irreversibly lost," and the respiratory centers were not destroyed but only less responsive to CO_2 (possibly due to secondary hypothyroidism), the result of that test is currently considered consistent

with the diagnosis of BD/BSD because no respiratory effort was observed at the conventionally (arbitrarily) established [Link et al, 1994] $PaCO_2$ level of 60 mmHg. Thus, the level of responsiveness to a test considered fundamental for the diagnosis of BD/BSD (the apnea test) is set arbitrarily, but the set level does not necessarily reflect irreversible loss of respiratory reflex or necrosis of respiratory centers as it has been proposed.

Sensitivity and specificity are important measures of the accuracy of any diagnostic test and even so, they are of no practical use to estimate the probability of disease in individual patients [Akobeng, 2007].
Accordingly, confirmatory tests consistent with the diagnosis of BD/BSD (including failure to demonstrate brain blood flow) may occur in patients that retain "critical" brain activities that should be absent for BD/BSD diagnosis [Joffe and Anton, 2007], as occurred with BBA. One study found that 5 of 9 patients without clinical BD had no evidence of brain blood flow on radionuclide angiography [Flowers and Patel, 1997].
Conversely, evidence of brain blood flow may be shown in patients who satisfy current diagnostic criteria for BD/BSD [Joffe and Anton, 2007]. Accordingly, BBA sustained (hypothalamic) control of body temperature from the beginning, later developed seizure-like episodes and showed EEG activity, despite repeated tests showing no evidence of blood flow. Taken together, these data indicate that the "confirmatory" tests currently used to demonstrate absence of brain blood flow for the diagnosis of BD/BSD do have a resolution threshold (sensitivity) below which a circulatory level enough to maintain neural function and vitality is not detected. The credit given to 4-vessel brain angiography as the "gold standard" for the diagnosis of BD/BSD [Link et al, 1994] implies the incorrect assumption that absent intracranial vascular opacification invariably correlates with absent brain blood flow (i.e. angiography has been thought to have full sensitivity for the diagnosis of BD/BSD).
Evidently, below that resolution threshold the content of intravascular contrast may be insufficient to generate the shadow image by X-ray beans.

Accordingly, some of the patients with intracranial hypertension presenting with deep coma (GCS score of 3) and cephalic arreflexia may be indisputably under global ischemic penumbra (i.e., presenting brain circulatory levels that may be low enough to reversibly suppress the "critical" functional activities for the diagnosis of BD/BSD, but not low enough to irreversibly compromise the vitality of the nervous tissue; brain blood flow is a continuous variable, so that reaching lethal ischemic levels without crossing the circulatory range of ischemic penumbra is physically unattainable [Coimbra. 1999]. In these patients, the apnea test may aggravate or cause irreversible brain damage by further reducing brain perfusion pressure or even establishing intracranial circulatory collapse [Coimbra, 1999]. Thus, current diagnostic procedures of BD/BSD were arbitrarily proposed in accordance with an assumption- based reasoning that is now disproved by evidence. Those procedures are not only unreliable in diagnosing irreversible brain damage but also may actually cause aggravation or irreversibility, while consuming a critical time-window for effective treatment that could avoid neuronal death and promote neurological recovery.

Therefore, the answer to the title question of this text is affirmative. Optimal results for the neurological recovery of "potential organ donors" may be achieved if a combination of therapeutic procedures (as those described here) is implemented for timely and simultaneous modulation of multiple damaging and regenerative mechanisms. The first i.v. administration of DMSO in head injury should occur as early as possible, ideally at the accident scene. While effective anti-oxidant therapy continues in the neurointensive care unit, maximal attention should be given to avoid any possible source of secondary damage such as hypotension (capable of raising the intracranial temperature to more than 42°C – the so-called "thermo-pooling phenomenon," secondary to hypotension and reduced brain blood flow leading to decreased washout of brain tissue temperature) [Hayashi et al, 1994], apnea, hypoxia, hypercarbia or hyperthermia. Systemic [Polderman et al, 2004] or selective neck/head [Qiu et al 2006] cooling should be considered.
Generous doses of nutraceuticals should be given to meet the high nutritional requirements determined by up-regulated metabolic processes

related to repair and re-synthesis of DNA, protein and phospholipids, and down-regulation of inflammatory mediators. Particular attention should be given to early detection of hypothalamic failure, with early and sustained replacement of the hormones that contribute to hemodynamic stability, respiratory function, normalization of capillary permeability to plasma proteins (control of brain edema) and stabilization of iron metabolism, and that potentially promote regenerative processes in the CNS, including in the hypothalamus. The level and response of proteinuria to therapy should be monitored from the hospital admission, as it may conceivably accompany brain edema and urinary loss of nutrients and hormones required for neuroregeneration.

Contrastingly, a large number of severely brain damaged patients world-wide inexorably progress into deep coma and loss of cephalic reflexes, being regarded as "potential organ donors" without having received even the simplest therapeutic item that recognizably could prevent the aggravation of their neurological status: vigorous and continuous antipyresis. The introduction of BD/BSD into medical practice, associated with reiterated claims for a routine of early apnea testing (opposing fundamental principles of neuro-intensive care and ethics) for timely harvesting of transplantable organs, may have contributed to this generalized lack of proper treatment to be provided to these patients, as well as to veiling of novel therapeutic perspectives to medical investigation.

Changing this scenario of therapeutic and research inertia faces a major conflict of interests and difficulties. Many doctors have invested several years of their lives constructing prosperous careers as transplant surgeons, and have reached the highest positions of medical hierarchy in hospitals, medical schools, Medical Councils of Ethics, and Medical Associations. Other medical specialties are cooperatively involved in the transplantation system, including neurologists, neurosurgeons and anesthesiologists, and others, such as nephrologists, have established transplantation as an attractive alternative to hemodialysis, maintaining a symbiotic professional association with the transplant system. Similarly,

hospitals receive a large percentage of their financial income from transplant activity, and consequently hospital directors, chief physicians and nurse managers command or vigorously influence the professional attitude of their hired professional staff towards any step of organ transplantation, including the most “sensitive” one – the approach to the donor's family members, who are probably never informed about the lethality of the apnea test.

In contrast, patients with severe brain damage may take weeks or months to recover only partially under a traditional (expectant) management at the expense of either private or public health systems. Discussing the validation of BD/BSD to implement exceptional therapies to recover patients who have already been declared BD/BSD by a hospital team invariably triggers hostile behavior, lack of cooperation and, likely, future retaliation. As happened with BBA, even two apnea tests may have already been performed, and most of the therapeutic window for exceptional therapies already elapsed. Despite these indications of poor prognosis, if the patient does recover, even partially to a persistent vegetative state, the hospital faces the possibility of being sued by family members. Additionally, any patient diagnosed as BD/BSD that show signs of neurological recovery may be regarded as a threat to credibility of the whole transplant system. Similarly, intra and inter-institutional political influences are also expected to act vigorously, protecting the transplantation system against any clinical research proposed to recover BD/BSD patients or even “potential organ donors.”

On the other hand, potentially effective therapeutic approaches that have been unveiled by preclinical and preliminary clinical reports (some of which were described here) have little possibility of being officially adopted in the management of brain damaged patients within a reasonable time period. They are usually inexpensive items and/or cannot be patent registered, and the chances of being the subject of exceedingly expensive “multicentric randomized double-blind clinical trials” are quite low, as no significant financial return from such investment may be expected by pharmaceutical industries by the time of their commercialization. Official

recognition of optimal therapy using combined items as those described here would have to await the unlikely conduction RTCs on each of these therapeutic measures.

Hopefully, this pessimistic scenario will eventually change, as these matters become more extensively known and discussed to a greater extent, involving a broader range of scientists and other critical professionals, rather than being confined to clinically active physicians whose careers in hospitals and universities (and even their license to work as physicians) may be decisively affected according to their outspoken attitude and expressed views on BD/BSD diagnostic practices.

When reviewing the literature for optimization of BBA's treatment, this author took weeks and months to perceive the critical importance that some poorly recognized (but easily treatable) pathophysiological phenomena may have for the outcome of severely brain damaged patients. Timely compensation of hypothalamic failure is an eloquent example, as it may ensure fast recovery with minor or no residual neurological deficits. Some pathophysiological events and treatment perspectives were only taken into proper consideration after her death, during this writing, while others are certainly yet to be understood. Although those perceptions were too late for BBA, the knowledge that resulted from the efforts to promote her neurological recovery may help other patients, according to the openness of the reader's mind in the search of truth for the sake of brain damaged, defenseless comatose patients.

Acknowledgements

The author pays tribute to BBA's parents and step-father, who demonstrated the magnitude of their love and strength of their character by sustaining indefatigable hope, by taking turns at her bedside for uninterrupted caregiving, and by struggling for the court order that enabled her treatment. The author feels privileged to have met exceptional professionals among the hospital staff, who showed humanitarian sensibility and dedication. Finally, the author is grateful to Dr. David W. Evans for reviewing the manuscript.

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