THE PONTIFICAL ACADEMY OF SCIENCES

EXCERPT OF SCRIPTA VARIA 110

Why the Concept of Brain Death is Valid as a Definition of Death

Statement by Neurologists and Others and Response to Objections

Weshalb das Konzept von Hirntod gültig ist als eine Definition von Tod

Stellungnahme von Neurologen und anderen und Antwort auf Einwände

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Declaración de neurólogos y otros y Respuesta a las objeciones

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VATICAN CITY
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WHY THE CONCEPT OF BRAIN DEATH IS VALID AS A DEFINITION OF DEATH

Statement by Neurologists and Others

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The Notion of Brain Death

The notion of 'brain death' was introduced to refer to a new criterion for the ascertainment of death (able to go beyond the criteria relating to the heart and breathing and the criteria relating to the destruction of the soma) that had become evident with new discoveries about the working of the brain and its role within the body, as well as necessary with the changed clinical situations brought about by the use of the ventilator and the possibility of sustaining human organs despite the loss of the unity of the organism as a whole.

Brain Death is Death

Brain death has been a highly important and useful concept for clinical medicine, but it continues to meet with resistance in certain circles. The reasons for this resistance pose questions for medical neurologists, who are perhaps in the best position to clarify the pitfalls of this controversial issue. To achieve consistency, an important initial clarification is that brain death is not a synonym for death, does not imply death, or is not equal to death, but 'is' death.

'Coma', the 'Persistent Vegetative State', and the 'Minimally Conscious State' are not Brain Death

The inclusion of the term 'death' in brain death may constitute a central problem, but the neurological community (with a few exceptions) acknowledges that something essential distinguishes brain death from all other types of severe brain dysfunction that encompass alterations of consciousness (for example, coma, vegetative state, and minimally conscious state). If the criteria for brain death are not met, the barrier between life and death is not crossed, no matter how severe and irreversible a brain injury may be.

Brain Death is the Death of the Individual

The concept of brain death does not seek to promote the notion that there is more than one form of death. Rather, this specific terminology relates to a particular state, within a sequence of events, that constitutes the death of an individual. Thus brain death means the irreversible cessation of all the vital activity of the brain (the cerebral hemispheres and the brain stem). This involves an irreversible loss of function of the brain cells and their total, or near total, destruction. The brain is dead and the functioning of the other organs is maintained directly and indirectly by artificial means. This state results solely and specifically from the use of modern medical techniques and, with only rare exceptions, it can only be maintained for a limited time. Technology can preserve the organs of a dead person (one appropriately pronounced dead by neurological criteria) for a period of time, usually only hours to days, rarely longer. Nevertheless, that individual is dead.

Death is the End of a Process

This process begins with an irreversible fact of health, namely the beginning of the failure of the integrative functions exerted by the brain and brain stem on the body. It ends with brain death and thus the death of the individual. Generally, this process involves an uncontrollable and progressive brain edema, causing the intracranial pressure to rise. When the intracranial pressure exceeds the systolic blood pressure, the heart is no longer capable of pumping blood through the brain. The swollen brain becomes compressed within its rigid 'shell', the skull, and herniates through the tentorium and the foramen magnum, which eventually totally blocks its own blood supply. Brain death and the death of the individual takes place as the end of this process. There is a second process which begins with the death of the indi-

vidual and involves the decomposition of the corpse and the dying of all the cells. The ancients were aware of these two processes and knew, for example, that hair and nails continue to grow for days after death. To think today that it is necessary to maintain the sub-systems of a corpse receiving artificial support, and to wait for the death of all the cells in the body before pronouncing the death of an individual would be to confuse these two processes. This latter approach has been termed 'exaggerated treatment' or, more specifically, the slowing down of the inexorable decomposition of a corpse through the use of artificial instruments.

The Consensus on Brain Death

The criterion of brain death as the death of an individual was established about forty years ago and since that time consensus on this criterion has increasingly grown. The most important academies of neurology in the world have adopted this criterion, as have most of the developed nations (the USA, France, Germany, Italy, the UK, Spain, the Netherlands, Belgium, Switzerland, Austria, India, Japan, Argentina and others) that have addressed this question. Unfortunately, there is insufficient explanation by the scientific world of this concept to public opinion which should be corrected. We need to achieve a convergence of views and to establish an agreed shared terminology. In addition, international organisations should seek to employ the same terms and definitions, which would help in the formulation of legislation. Naturally, public opinion must be convinced that the application of the criterion of brain death is carried out with the maximum rigour and efficacy. Governments should ensure that suitable resources, professional expertise and legislative frameworks are provided to ensure this end.

Statistics on Brain Death

In the USA, most of the statistics on cases of the diagnosis of recognised brain death since its full definition, its application, and the clinical histories involved are generally available in organ procurement offices. The Mayo Clinic has information on about 385 cases (years 1987-1996). Flowers and Patel (*Southern Medical Journal* 2000; 93:203-206), reported on 71 individuals who met the clinical criteria of brain death and then were studied by the use of radionuclide brain scans. No blood flow was demonstrated in 70 patients and in 1 patient arterial blood flow was present on the initial evaluation but disappeared 24 hours later. The authors concluded that using established medical criteria the accuracy of the diagnosis of brain death was

100%. The famous Repertinger meningitis case ironically demonstrates that it is possible to keep a body and organs perfused for a long period of time. One possibility is that this patient may not have been brain dead for a long period of time (cf. the detailed discussion on this possibility during the meeting and question 15, p. LXIX ff.). Another possibility is that this represents a valid case of brain death since all of the clinical tests were performed to ascertain brain death except the apnea test. The absent evoked potentials and the flat EEG were consistent with brain death. If this was a validly documented case of brain death, it makes the point that in extraordinarily rare exceptions this kind of case occurs. However, many years have passed since this case, there is a great deal of uncertainty about it, and one cannot generalise from it to invalidate the criteria for brain death. With the technologies available in modern intensive care units, we may see more of such prolonged cases, as technological capacity develops to reproduce some of the functions of the brain stem and hypothalamus in the integration and coordination of all the sub-systems of the body. The neurological community does not believe that this case disturbs the conceptual validity of brain death as being equivalent to human death.

A Counterintuitive Reality

The history of science and of medicine contains many discoveries that are contrary to our perceptions and seem counterintuitive. Just as it was difficult for common sense to accept, at the time of Copernicus and Galileo, that the earth was not stationary, so it is sometimes difficult now for people to accept that a body with a pumping heart and a pulse is 'dead' and thus a corpse; 'heart-beating death' appears to defy our common sense perceptions. In part, this is because the dead brain, like the moving earth, cannot be seen, conceptualised, or experienced by the onlooker. Indeed, the common man does not easily accept that a deep sleep-like state with a heartbeat, accompanied by electrocardiogram activity, is death. Since the use of medical technology is so ubiquitous, it is easy to fail to comprehend that a ventilator machine is a necessary intermediary in maintaining this state. This may give rise to a deep-seated reluctance both to abandon brain-dead individuals and to accept the removal of organs from their bodies for the purposes of transplantation.

Organ Transplantations

The concept of brain death has been at the centre of a philosophical and clinical debate, especially after advances made in the field of transplan-

tations. In particular, it has been asked whether this criterion – and this is the view, for example, of Hans Jonas – was introduced to favour organ transplantations and is influenced by a dualistic vision of man that identifies what is specific to man with his cerebral activities. Yet, as emerged during discussions of the meeting, the criterion of brain death is compatible at a philosophical and theological level with a non-functionalist vision of man. St Augustine himself, who certainly did not identify the brain with the mind or the soul, was able to say that when 'the brain by which the body is governed fails', the soul separates from the body: 'Thus, when the functions of the brain which are, so to speak, at the service of the soul, cease completely because of some defect or perturbation – since the messengers of the sensations and the agents of movement no longer act –, it is as if the soul was no longer present and was not [in the body], and it has gone away' (*De Gen. ad lit.*, L. VII, chap. 19; PL 34, 365). Indeed, the criterion of brain death is in conformity with the 'sound anthropology' of John Paul II, which sees death as the separation of the soul from the body, 'consisting in the total disintegration of that unitary and integrated whole that is the personal self'. Thus, in relation to the criterion of brain death, the Pope was able to declare: 'the criterion adopted in more recent times for ascertaining the fact of death, namely the *complete* and *irreversible* cessation of all brain activity (in the cerebrum, cerebellum and brain stem) if rigorously applied, does not seem to conflict with the essential elements of a sound anthropology' (Cf. Address of 29 August 2000 to the 18th International Congress of the Transplantation Society).

From a clinical point of view, almost the whole of the medical community agrees that the concept of brain death as death should not serve an ulterior purpose (specifically: organ transplantation). Indeed, the ascertainment of brain death, which in historical terms was the result of the independent study of the brain, preceded the first transplantation procedures and thus was (and therefore is) unconnected with the related subject of transplants (cf., e.g., S. Lofstedt and G. von Reis, 'Intracranial lesions with abolished passage of X-ray contrast throughout the internal carotid arteries', *PACE*, 1956, 8, 99-202). Few physicians are convinced that the removal of organs from brain-dead individuals amounts to murder, and there is no reasonable legislation that adopts this point of view. The advent of cardiac and hepatic transplantation in the 1960s, and the need for organs from heart-beating donors to ensure successful results, generated an evident relationship between brain death and transplants. In the future, it is possible and to be hoped, that this relationship will diminish with new discoveries in the use of natural non-human and artificial organs.

Unsound Arguments

Most of the arguments against brain death are not sustainable and are incorrect diversions when scrutinised from a neurological perspective. For example, the erroneous or imprecise application of the criteria of brain death, the fact that the neurological examination in individual cases may be misinterpreted, or variations in the criteria chosen by specialist groups, can all too easily be used as spurious arguments against the concept.

The Apnea Test

The claims that apnea testing poses a risk to the patient are largely invalid when the testing is performed properly. Authorities should ensure that apnea testing is always carried out with the maximum of professional and technological expertise, and dedicate resources to this end.

Irreversible Situations: All Death is Brain Death

Assertions as to the existence of 'awakenings' from brain death have been used to discredit the concept and to prolong artificial ventilation, feeding and medical support in the hope of a recovery. A small number of cases of brain-dead individuals maintained in this state with ventilators and other medical measures for weeks, or even years, have given rise to unfounded claims that these subjects were in conditions other than death. In reality, as observed above in the section on 'statistics on brain death', where the proper diagnostic criteria have been employed all such assertions are not valid.

Pregnancy

Pregnancies have been carried to term in brain-dead mothers. These cases are exceptional and do not involve potentially reversible conditions different from brain death. The mother's uterus and other organs are being supported as a technical vessel for pregnancy, in much the same way that the heart or the kidneys are kept perfused. Thus, it is possible for an individual who is brain dead to give birth, if maintained with a ventilator, or other measures, for a certain period.

Antidiuretic and Other Pituitary Hormones

Other spurious arguments, such as the residual excretion of antidiuretic and other pituitary hormones in some cases of brain death, refer to tran-

sient phenomena, and are technical arguments that can be dealt with on a practical level. There is no need for every single cell inside the cranium to be dead for brain death to be confirmed.

Axon Regeneration

Recent reports of axon regeneration in patients with severe brain damage (which require corroboration and more study) are not pertinent to brain death.

Recovery Excluded

It follows, as mentioned earlier, that there is no chance of recovery from brain death and that discussions regarding recovery from various states of coma must be distinguished from brain death.

The Need for an Expert Neurological Examination

If the criteria of brain death are correctly applied, and if the neurological examination is carried out correctly by an experienced physician, then full reliability can be achieved. As mentioned above, there have been no documented exceptions. The neurological examination evaluates consciousness and reflexes to confirm death of the neurons involved in these functions. Although every neuron in the central nervous system is not assessed during the examination, as stated earlier it is not necessary for absolutely all neurons to be dead for brain death to be reliably diagnosed. In a sedated or previously sedated patient, the lack of perfusion of the brain must be demonstrated for brain death to be ascertained beyond all doubt.

The Loss of Heart Activity

When the cardiologist pronounces death as a result of cardiac standstill, the diagnosis is less certain than in the circumstance of brain death. Many documented cases exist of patients pronounced dead after failure of cardiac resuscitation who have subsequently been discovered to be alive. It should be further stated that the traditional definition of natural loss of heart activity as 'death' is not satisfactory because it is now possible to keep the heart beating by artificial means and blood circulation to the brain can be maintained artificially to a brain that is dead. Confusion arises from the presence of mechanical systems that artificially replace the role of the brain as the generator of the functioning of essential organs.

Therefore, brain death is a much more certain diagnosis than heart death. The reluctance to accept brain death may be mostly related to the fact that it is a relatively new concept (the invention of the ventilator by Ibsen took place fifty-six years ago) compared to the traditionally accepted notion of cardiac and respiratory arrest.

The Loss of Breathing

If one proposes that the loss of spontaneous breathing defines death, then all brain-dead patients are, by definition, 'dead'. When the patient has been pronounced dead after the application of the appropriate criteria of brain death, the decision to continue with ventilation can only be justified with reference to the life and wellbeing of another person.

No Ventilator, No Heart Activity

If one removes the ventilator from a brain-dead patient, the body undergoes the same sequence of events and physical dissolution as occurs in an individual who has undergone loss of heart activity.

Artificial Instruments

Thus, it is as illogical to contend that death is the loss of heart activity as it is to affirm that the loss of kidney activity is death. Indeed, both renal activity (through dialysis) and heart activity (with a non-natural instrument) can be supported artificially, something that is impossible in the case of the brain: no artificial instrument exists that can reactivate or replace the brain after it has died.

No Circulation to the Brain Means Brain Death

One does not have to be a Cartesian to assert the central importance of the brain. Today, after advances in our knowledge of the workings of the brain, it is the medical-philosophical view that the body is 'directed' by that marvellous organ, the brain. Certainly, we are not a 'brain in a vat' but it has to be recognised that the brain is the receiving centre of all sensory, cognitive, and emotional experiences and that the brain acts as the neural central driving force of existence. We must acknowledge that the loss of circulation to the brain causes death. This loss of circulation can be documented in virtually all cases of brain death if tests are performed at the proper time.

The Camouflaging of Death

In reality, the ventilator and not the individual, artificially maintains the appearance of vitality of the body. Thus, in a condition of brain death, the so-called life of the parts of the body is 'artificial life' and not natural life. In essence, an artificial instrument has become the principal cause of such a non-natural 'life'. In this way, death is camouflaged or masked by the use of the artificial instrument.

Education and Brain Death

One of the tasks of physicians in general and neuroscientists is to educate the public about discoveries in this field. As regards the concept that all death is brain death, this task may be difficult, but it is our duty to continue in such an endeavour.

At a specific level, the relatives of brain-dead individuals should be told that their relative has died rather than that he is 'brain-dead', with the accompanying explanation that the support systems produce only an appearance of life. Equally, the terms 'life-support' and 'treatment' should not be employed because in reality support systems are being provided to a corpse.

RESPONSE TO THE STATEMENT AND COMMENTS OF PROF. SPAEMANN AND DR. SHEWMON

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Dr. Shewmon criticises many of the conclusions of the statement 'Why the Concept of Brain Death is Valid as a Definition of Death' and some of the views expressed during the general discussion. His points could be considered contributions to the debate. Aristotle teaches us to be grateful not only to those whose views we share but also to those who express different opinions, because they too have contributed to the stimulation of reflection.[1] We regret that Dr. Shewmon could not attend the PAS in September, so that we could have debated his criticism in person, rather than in retrospect.

Dr. Shewmon and Prof. Spaemann may never agree that death of the brain is the death of the individual. However, there are certain statements upon which we all agree:

1. Meeting the clinical criteria for brain death establishes that that individual will never, ever, recover any semblance of consciousness or conscious activity.
2. The vast majority of bodies meeting the brain death criteria will suffer multi-organ failure including cardiac arrest within a short period of time, despite major efforts to preserve somatic organs. This is true despite the original injury being restricted to the brain, as for example a massive cerebral haemorrhage.
3. In a small minority of such bodies, somatic organs, including the heart, may be kept functioning for a period of time, usually a few days, some-

[1] Cf. *Met.*, II, 1, 993 b 12 ff.

times weeks and in extremely rare instances for an extended period. No matter how long somatic function is sustained, when brain death has been appropriately diagnosed, no semblance of consciousness or conscious activity will ever occur.

4. That the phrase 'physiological decapitation' applied to brain death should be avoided because a decapitation is contrary to physiology, which refers to the normal functions of living organisms and their parts, and because brain dead subjects can still, indeed, have heads.

An overwhelming number of medical experts, including those attending the Vatican Symposium, agree with the above propositions. One finds it difficult to understand why Dr. Shewmon and Prof. Spaemann, while accepting these statements about brain death, do not accept that brain death is the death of the individual. However, we can say that their refusal is based on personal physical/biological and philosophical views. From the physical/biological point of view, they affirm that the integration and coordination of the bodily sub-systems are not performed exclusively by the brainstem and hypothalamus. And thus for them, there is a holistic vital unity of the organs of a body without the brain.

Perhaps this point can be further clarified if we contrast brain death with a vegetative state. Why is the persistent vegetative state different from brain death? Given the same supportive care as a brain-dead body, a patient in a vegetative state is unlikely to die, suggesting that the brainstem, and particularly the lower brainstem, is important for the integrative function of the rest of the body, whereas the cerebral hemispheres are not.

There are other differences between the vegetative state and brain death. 1) Functional MRI suggests that elements of consciousness may be present in patients who are vegetative. 2) There are reports describing recovery of at least minimal consciousness after many months in a vegetative state. Thus, we should not make the diagnosis of a 'persistent' vegetative state for the first three months, and for the first year following head trauma. 3) Several papers, addressing the issue of keeping somatic organs functioning after the brain has died, demonstrate that it is extremely difficult and, with rare exceptions (not, as Dr. Shewmon suggests, 'common' exceptions), fails after a few days. This contrasts with the relative ease of maintaining individuals with severe brain or spinal cord injury who are not brain dead. That an individual whose spinal cord has been severed at the high cervical level and is ventilator-dependent, can be sustained to live and work at home, indicates the importance of the brain in the integrative function of the rest of the body. That it is easier to maintain the somatic organs of a vegetative patient than those of a brain dead subject also attests to the importance of the brain, in this case the

brainstem, in integrating the function of the remainder of the body, which, in part, explains why the vegetative state is not equated with death.

Thus we believe that once the clinical criteria for brain death are present, the individuals are as dead as if their hearts had stopped.

In addition, as regards the precise issue of whether the brainstem and hypothalamus are the integrators of 'all' bodily function, Dr. Shewmon seeks to present evidence that the integration and coordination of the bodily subsystems are not performed exclusively by the brainstem and hypothalamus. To what kind of integration and coordination does he refer? The vast majority of neurologists believe that all of the functions relevant to the state of life are performed there, in the brainstem and hypothalamus, structures that are indeed the integrators of the main systems and sub-systems of the body. The brain integrates all functions of the body, through nerves, neural transmitters and secreted substances, the latter a process that Dr. Shewmon ignores when he compares spinal cord sectioned individuals with those who are brain dead. Thus, it is unclear as to what sub-systems Dr. Shewmon is referring; the rare subjects who are brain dead, but whose organs survive for weeks or months, indicate that some organs such as the kidney and the digestive system can function independently of the brain, but whether they can integrate with each other is less clear. For that matter, as certain papers demonstrated, if the technical support is adequate, one can maintain certain organs (i.e. heart) isolated from the body in a system of perfusion for days. Thus, it should not be surprising that if these organs are perfused within the soma (their natural location), they can remain active within a corpse. One can accept that the holistic physiological properties of the soma in a brain dead subject are greater than in a collection of perfused organs, i.e. that the interaction between organs within the ventilated soma is greater than that occurring with separated organs maintained in a vat. However, these experiments do not imply that an integration and co-ordination exists without the brain. Whatever 'integrative sub-systems' the rest of the body may have, they are few, fragile, and poorly coordinated, and one cannot sustain them once the brain has died. The other bodily structures that effect some integration (nerves in the heart and bowel or bones that make up the skeleton, for example) are entirely irrelevant in discussions about brain death as the death of the individual. The ancients knew about these other integrative forms through their observation of hair and nail growth in corpses, but did not doubt that the individual was dead. Thus, in opposition to Dr. Shewmon's affirmations, with the death of the brain an inexorable process of disintegration of the body begins that a ventilator can only slow down. Therefore, as affirmed in the Statement, this process of disintegration is different from the

death of the individual, which begins with an irreversible fact of health and ends with brain death and thus the death of the individual.

Moreover, if it is asserted that the brain in the embryo does not 'mediate' the integrative unity of the organism, then it is evident that the word 'organism' is being used in an inappropriate way. The embryo is the first stage in the development of a multi-cellular organism (it immediately follows the fusion of the pronuclei in the ovule) but it is not properly an organic body. What is specifically called an organic body is one that has a diversity of organs. This is not the case with an embryo because it has not yet developed a system of organs. Thus there cannot be mediation between the organs, either between the brain and the other organs or between the various organs, because the organs have not yet developed and are still in potency. There is, therefore, a radical difference, from the point of view of integration, between a situation of brain death and that of an embryo that has not yet developed its organs. This fact invalidates the parallel made between the embryo and a brain-dead body.

At this point, given their gross underestimation of the importance of the brain for the integrative function of the rest of the body, Prof. Spaemann and Dr. Shewmon affirm that the adoption of brain death as death by neurologists is not physical/biological but philosophical. In other words, according to Prof. Spaemann and Dr. Shewmon, since neurologists are not able to justify the presumed sub-integration of the body without the brain, to state that brain death is the death of the individual, neurologists are compelled to identify the brain with the mind or personhood, which is a philosophical statement.

It was clear from the direction of the meeting that the task was to focus first and foremost on the scientific approaches. Indeed, the only philosophical paper was that given by Prof. Spaemann who opposed brain death as the criterion for death. However, from the discussions during the meeting, it emerged (a point not answered by Prof. Spaemann) that although the mind is not the same as the brain, one cannot today reasonably doubt that human intelligence (and in part personhood) depend on the brain as the centre of the nervous system and other biological systems. Although we certainly do not currently have a detailed understanding of the physical modalities of human thought, it is an established scientific fact that human intelligence depends on the support of nerve cells and the organisation of billions of connections between the billions of neurons that make up the human brain and its ramifications within the human body. This does not mean that one could conclude in haste that contemporary neuroscience has definitively demonstrated the truth of a materialistic monism and rejected the presence of a spiritual reality in man.

According to the post-Second Vatican Council and contemporary *Catechism of the Catholic Church*, 'The unity of soul and body is so profound that one has to consider the soul to be the "form" of the body:[2] i.e., it is because of its spiritual soul that the body made of matter becomes a living, human body' (n. 365). So, from a philosophical and theological point of view, it is the soul that confers on the body the unity and the essential quality of the human body, which are reflected in the dynamic unity of the cognitive (and inclinational) activities with the sensitive and vegetative activities that not only co-exist, but can also work together in a participation of the nervous system with the senses and the intellect (and in a participation of the biological and sensitive inclinations with the will). Thus, Aristotle, using a geometric analogy of contemporary relevance that is explicitly appropriate for this operative order as well, declared that the vegetative is in the sensitive and this is in the intellective in the same way that a triangle is in a square and this is in a pentagon, because this last contains the square and even more.[3] This dynamic organic unity between the activity of the intellect, the senses, the brain and the body does not exclude but, on the contrary, postulates, at a biological and organic level, that there is an organ which has the role of directing, coordinating and integrating the activities of the whole body. Each specific function carries out its activity as an integral part of the whole. In contrary fashion, the fact of suggesting a sort of equivalence or equality of functions and of their activities leads us to acknowledge their relative independence, which is contradictory to the idea of 'organism'. So the brain is the centre of the nervous system but it cannot function without the essential parts of its connectivity throughout the organism, in the same way as the organism cannot function without its centre. We are not brains in a vat, but neither are we bodies without a brain.

Therefore, brain function is necessary for this dynamic and operative physiological unity of the organism (over and above its role in consciousness), but not for the ontological unity of the organism, which is directly conferred by the soul without any mediation of the brain, as is demonstrated by the embryo. However, if the brain cannot assure this functional unity with the organic body because the brain cells are dead or the brain has been separated from the organism, the capacity of the body to receive the being and the unity of the soul disappears, with the consequent separation of the soul from the body, i.e. the death of the organism as a whole.

[2] Cf. Council of Vienna (1312): DS 902.
[3] Cf. *De Anima*, II, 3, 414 b 20-32.

The formula constituting the source of the definition of the Council of Vienna that the soul is '*forma corporis*', postulates, from the operative and dynamic point of view, the other formula of St Thomas (for that matter not cited by Prof. Spaemann) to the effect that 'the government of the body belongs to the soul in that it is its motor and not its form'[4] and thus 'between the soul and all the body, in that it is a motor and the principle of operations, occurs something intermediary, because, through a first part moved first, the soul moves the other parts to their operations' ('*inter animam secundum quod est motor et principium operationum et totum corpus, cadit aliquid medium; quia mediante aliqua prima parte primo mota movet alias partes ad suas operationes*').[5] Thus the overall formula obscured by tradition and by Prof. Spaemann is: 'the soul unites to the body as a form without an intermediary, but as a motor it does this through an intermediary' (*anima unitur corpore ut forma sine medio, ut motor autem per medium*).[6] Therefore, when the cells of the brain die, the individual dies, not because the brain is the same as the mind or personhood, but because this intermediary of the soul in its dynamic and operative function (as a motor) within the body has been removed – 'that disposition by which the body is disposed for union with the soul'.[7] One must see this intermediation of the brain not as delegation from outside but as a part of reality and this is what the traditional notion of 'principal organ' or '*instrumentum coniunctum*' seeks to express. St Augustine, who was the source of this Thomistic doctrine of the government of the body by the soul through an organ which is the principal instrument, is very clear in asserting *avant la lettre* that brain death is the death of the individual: 'Thus, when the functions of the brain which are, so to speak, at the service of the soul, cease completely because of some defect or perturbation – since the messengers of the sensations and the agents of movement no longer act –, it is as if the soul was no longer present and was not [in the body], and it has gone away' (*Denique, dum haec eius tamquam ministeria vitio quolibet seu perturbatione omni modo deficiunt desistentibus nuntiis sentiendi et ministris movendi, tamquam non habens cur adsit abscedit [anima]*).[8] Therefore, in reality the

[4] St Thomas Aquinas, *Q. de spiritualibus creaturis*, a. 2 ad 7.

[5] *Ibid.*, *Q. de Anima*, a. 9.

[6] *Loc. cit.*

[7] St Thomas Aquinas, *S.Th.*, I, 76, 7 ad 2.

[8] *De Gen. ad lit.*, L. VII, chap. 19; PL 34, 365. It would appear that St. Thomas Aquinas arrived at the same conclusion about the centrality of the head when he stated: 'The head has three privileges in relation to the other members. Firstly, it is distinguished from the others in the order of dignity because it is the principle and it presides. Secondly, because

objections to the criterion of brain death as death advanced by Prof. Spaemann and Dr. Shewmon do not hold up either at a physical/biological or a philosophical level.

We also disagree with Dr. Shewmon's conclusion that the worldwide consensus on the equivalency of brain death with human death is 'superficial and fragile'. Although practices vary between countries, there does exist a consensus of sufficient strength to permit the successful declaration of brain death in dozens of countries in the developed Western world and the non-Western and developing world that have addressed this question and possess the necessary state-of-the-art technology.

of its fullness of senses in that all senses are in the head. Thirdly, because of a certain influence of sense and movement on the members': '*Caput enim respectu aliorum membrorum habet tria privilegia. Primo, quia distinguitur ab aliis ordine dignitatis, quia est principium et praesidens; secundo in plenitudine sensuum, qui sunt omnes in capite; tertio in quodam influxu sensus et motus ad membra*' (*Super Colossenses*, cap. 1, lect. 5, Marietti, Rome, 1953, vol. 2, p. 135, n. 47).

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To Our Venerable Brother
Msgr. Marcelo Sánchez Sorondo,
Chancellor of the Pontifical Academy of Sciences

On 11-12 September of this year the Pontifical Academy of Sciences will organise a study seminar to further extend its study of subjects and issues connected with the last stage of man's life on earth. This significant meeting is to be located in the furrow of the centuries-old tradition of the Pontifical Academy of Sciences, whose task has been, and continues to be, that of offering the scientific community a valid and qualified contribution to the solution of those relevant scientific-technical problems that are at the basis of the development of mankind, taking into due consideration the moral, ethical and spiritual aspects of every question as well.

In performing its special service, the Pontifical Academy of Sciences always refers to the data of science and to the teachings of the Magisterium of the Church. In particular, as regards this study meeting, Christian Revelation also invites the man of our time, who tries in so many ways to find the true and profound meaning of his existence, to address the subject of death by projecting his gaze beyond pure human reality and by opening his mind to the mystery of God. It is, indeed, in the light of God that the human creature better understands himself and his own definitive destiny, and the value and meaning of his life, which is the precious and irreplaceable gift of the Almighty Creator.

While cordially greeting those taking part in the working group, I hope and wish that the shared reflection will prove useful in producing opportune clarifications on aspects that concern such an important human question. And, assuring you of my spiritual nearness through prayer, I most willingly send to you, to the President of the Pontifical Academy of Sciences, and to all the distinguished scholars present, an Apostolic Blessing.

From Castelgandolfo, 8 September 2006