"Brainstem Death," "Brain Death" and Death: A Critical Re-Evaluation of the Purported Equivalence

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ABSTRACT: The author challenges brain-based diagnoses of death by re-examining the concept of death, its definition, the anatomical criterion, and the clinical signs or tests. Dr. Shewmon challenges the fundamental assumptions underlying brain death: (1) that the brain is the body's "critical system"; and (2) that the body even has a localized "critical system." He does not redefine death, but shifts the anatomical criterion from a single focus (the brain) to the entire body. The clinical tests correspondingly shift from those implying loss of brain function to those implying thermodynamically supracritical microstructural damage diffusely throughout the body. He concludes that the notion of "brain death" as bodily death is logically and physiologically incoherent, and that its replacement by something scientifically more credible would promote not only the sanctity of life, but ironically even transplantation as well.

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Introduction

Statement of the Problem

Brain-based diagnoses of death are now legally recognized in most developed countries of the world. This widespread consensus is split into two basic camps, following either the U.S. "whole brain" or the British "brainstem" formulation of so-called "brain death." As nicely summarized by Pallis and Harley,[1] the essential points of the disagreement over detail are twofold:

(1) What is "the critical system of the body's critical system"? (That is, what part of the brain is to the brain as the brain is to the body?)—and

(2) Can physicians identify the death of the brainstem by exclusively clinical (non-instrumental) methods?

It may come as a surprise to some readers that I shall not be arguing here the United States' side of that debate. Rather, my goal is much more radical: to challenge certain fundamental assumptions common to both sides, specifically that:

(1) the body's "critical system" is the brain, and

(2) the body even *has* a localized "critical system."

Background

First some background. As a neurologist in a major academic transplant center, I have extensive clinical experience with "brain death." And as a convert from atheism to theism, I have a particular interest in the relationships among brain, mind, body, and soul.

In the early and mid-1980s I was a strong proponent of the notion that human death was essentially neurological in nature, that death of the entire brain was death of the person, and that the most convincing rationale for that equivalence also happened to imply that "neocortical death" was equally death.[2] This opinion evolved to a modified version of "whole brain death," which I presented in 1989 at the Pontifical Academy of Sciences.[3] Since then, I have come to reject all brain-based formulations of death.[4]

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[1]CHRISTOPHER A. PALLIS & D.H. HARLEY, ABC OF BRAINSTEM DEATH 6 (London, BMJ Publishing Group, 2nd ed., 1996).

[2]D. Alan Shewmon, *The Metaphysics of Brain Death, Persistent Vegetative State, and Dementia*, 49 THOMIST 24 (1985).

[3]D. Alan Shewmon, *"Brain Death": A Valid Theme with Invalid Variations, Blurred by Semantic Ambiguity*, in WORKING GROUP ON THE DETERMINATION OF BRAIN DEATH AND ITS RELATIONSHIP TO HUMAN DEATH 23 (R.J. White et al. eds., Vatican City, Pontifical Academy of Sciences, 1992).

[4]D. Alan Shewmon, *Recovery From "Brain Death": A Neurologist's Apologia*, 64 LINACRE Q. 30 (1997).

Thus, I am thoroughly conversant first-hand with the arguments on all sides of the debate.

Until the turn of the decade, most people thought that "brain death" was a settled issue; it no longer is. An increasing number of experts have begun to re-examine critically and to reject various key underlying assumptions.[5]

Of particular interest is the recent public debate in Germany over incorporating "brain death" into statutory law.[6] A surprising number of intellectuals have argued against it, not the least of whom is the archbishop of Cologne, Joachim Cardinal Meisner, who stated officially that "the

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[5]Jeffrey R. Botkin & Stephen G. Post, *Confusion in the Determination of Death: Distinguishing Philosophy From Physiology*, 36 PERSP. BIOLOGY & MED. 129 (1992).

See also Paul A. Byrne & Richard G. Nilges, *The Brain Stem in Brain Death: A Critical Review*, 9 ISSUES IN LAW & MED. 3 (1993); THE DANISH COUNCIL OF ETHICS, DEATH CRITERIA: A REPORT: THE DANISH COUNCIL OF ETHICS FIRST ANNUAL REPORT, 1988 (1989); THE DANISH COUNCIL OF ETHICS, FETAL DIAGNOSIS AND ETHICS: A REPORT: 3RD YEAR OF THE DANISH COUNCIL OF ETHICS, 1990 (1991); Martyn Evans, *Against Brainstem Death, in* PRINCIPLES OF HEALTH CARE ETHICS 1041 (Raanan Gillon ed., 1994); Amir Halevy & Baruch Brody, *Brain Death: Reconciling Definitions, Criteria, and Tests*, 119 ANNALS INTERNAL MED. 519 (1993); David Albert Jones, *Nagging Doubts About Brain-Death*, CATH. MED. Q., Feb. 1995, at 6; P. Rodríguez del Pozo, *La Muerte Cerebral: ¿Diagnóstico o Pronóstico?*, 44 JANO 85 (1993); Robert M. Taylor, *Reexamining the Definition and Criteria of Death*, 17 SEMINARS NEUROLOGY 265 (1997); Robert D. Truog, *Is it Time to Abandon Brain Death?* 27 HASTINGS CENTER REP., Jan.-Feb. 1997, at 29; Robert M. Veatch, *The Impending Collapse of the Whole-Brain Definition of Death*, 23 HASTINGS CENTER REP., July-Aug. 1993, at 18; Y. Watanabe, *Once Again on Cardiac Transplantation: Flaws in the Logic of the Proponents*, 38 JAPANESE HEART J. 617 (1997); Stuart J. Youngner, *Defining Death: A Superficial and Fragile Consensus*, 49 ARCHIVES NEUROLOGY 570 (1992); and Stuart J. Youngner, *Brain Death: Another Layer of Confusion*, 10 CENTER VIEWS, Spring 1996, at 1, 4-5 [Center for Biomedical Ethics, Case W. Res. U. Sch. of Med.].

[6]M. Klein, *Hirntod: Vollständiger und irreversibler Verlust aller Hirnfunktionen?* [*Brain Death: Irreversible Loss of All Brain Functions?*], 7 Ethik Med. 6 (1995).

See M. Klein, *Es gab keine Debatte darüber, was wir unter Tod verstehen wollen. Warum der Hirntod nicht mit dem Tod identisch ist und trotzdem Organe entnommen werden können* [*There was no Disagreement Over How we Should Understand Death. Why Brain Death is not Identical to Death and Why it is Permissible to Remove Organs Anyway*], FRANKFURTER RUNDSCHAU (Frankfurt), Nov. 7, 1996, at 12; E. Schmidt-Jortzig & E. von Klaeden, *Leichen bekommen kein Fieber. Die Fragwürdigkeit des Hirntod-Kriteriums* [*Corpses do Not Develop Fever. The Legitimacy of Brain-Death Criteria*], FRANKFURTER ALLGEMEINE ZEITUNG (Frankfurt), May 13, 1997, at 15; K. Stapenhorst, *Über die biologisch-naturwissenschaftlich unzulässige Gleichsetzung von Hirntod und Individualtod und ihre Folgen für die Medizin* [*The Biological and Scientific Difference Between Brain Death and Human Death and the Ethical Consequences for the Physician*], 8 ETHIK MED. 79 (1996); H. Thomas, *Sind Hirntote Lebende ohne Hirnfunktionen oder Tote mit erhaltenen Körperfunktionen?* [*Are the Brain Dead Alive but Without Brain Functions, Or Are They Dead but Still in Possession of Body Functions?*], 6 ETHIK MED. 189 (1994).

identification of brain death with death of the person is from a Christian point of view no longer justifiable."[7] As a testimony to the intensity of the controversy, the finally adopted law merely specified "brain death" as a legal requirement for organ harvesting without actually declaring it to be death.[8]

The position against "brain death" that will be advanced here must *not* be misconstrued as necessarily anti-transplantation.[9] The equating of "brain death" with death was in retrospect quite unnecessary, even for the utilitarian purposes which historically inspired it.[10] Through a variation on the "non-heart-beating donor" approach,[11] it is possible to remove vital organs from a patient just disconnected from extraordinary ("disproportionate") means of support, after final cessation of heartbeat and circulation but before actual death (to be defined below), *in such a way that death is neither caused nor even hastened* by the organ removal. A number of other ethical prerequisites must of course also be assumed: (1) that the decision to discontinue the extraordinary means (typically a mechanical ventilator) be appropriate and ethical on its own ground (and irreversible coma due to extensive brain destruction seems a particularly appropriate circumstance), (2) that the decision to discontinue extraordinary means be not influenced by considerations of organ donation, (3) that fully informed consent be given and the donation of organs be truly voluntary (let us prescind, for the sake of focus, from ethical complications introduced by proxy decisionmaking, such as with pediatric donors or adults who had not previously expressed an intention concerning donation).

Whether these requirements for theoretical legitimacy can always be fulfilled in practice is an important separate issue, which could in some cases exclude this approach. But assuming moral licitness, the procedure would not begin until after final (though not yet irreversible) circulatory standstill following discontinuation of the ventilator and after a latency sufficient for moral certainty that the heart will not spontaneously start

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[7] J. Meisner, *Erklärung des Erzbischofs von Köln zum beabsichtigten Transplantationsgesetz [Declaration of the Archbishop of Cologne Concerning the Proposed Transplantation Law]* PRESSEAMT DES ERZBISTUMS KÖLN (Köln, Germany), Sept. 27, 1996, at 1; J. Meisner, *Wann trennen sich Seele und Leib? [When do the Body and Soul Separate?]*, FRANKFURTER ALLGEMEINE ZEITUNG (Frankfurt), Jan. 25, 1997, at 14.

[8] Sandra Goldbeck-Wood, *Germany Passes New Transplant Law*, 315 BRIT. MED. J. 11 (1997).

[9] Shewmon, *supra* note 4.

[10] PETER SINGER, RETHINKING LIFE & DEATH: THE COLLAPSE OF OUR TRADITIONAL ETHICS (1995).

[11] PROCURING ORGANS FOR TRANSPLANT: THE DEBATE OVER NON-HEART-BEATING CADAVER PROTOCOLS (Robert M. Arnold et al., eds., 1995). *See also* David P.T. Price, *Organ Transplant Initiatives. The Twilight Zone*. 23 J. MED. ETHICS 170 (1997).

beating again if the body is left undisturbed (probably a couple of minutes would suffice). With prior informed consent, arterial catheters could already have been placed, through which to perfuse organs of interest with a cool preservative to minimize their deterioration from lack of oxygen. Although the heart is still in principle resuscitatable, if the foregoing of the ventilator is ethical, all the more so would be the foregoing of resuscitation immediately thereafter. In this very restricted and well defined context, excision of the non-beating heart (which if left alone would remain permanently non-beating) in no way alters the circulation-less body's physiology during the remaining few minutes of the dying process. Thus, transplantation techniques *could* be modified (and in some centers already have been) to fall under the moral rubric of donation *inter vivos* rather than of the Fifth Commandment or the so-called "dead-donor rule."[12] Significantly, this was in fact precisely how the first successful heart[13] and liver[14] transplants were carried out in 1967, prior to the legal equation of "brain death" with death.[15]

This approach to transplantation deserves further research into means of improving outcomes as well as urgent and intense study by expert moralists. I mention this alternative here, not because I am on any sort of promotional bandwagon, but in order to encourage such study and to reassure the transplant community that the conceptual demise of "brain death" would not necessarily entail the demise of organ transplantation, although it would surely require a radical change in the *modus operandi* for obtaining donor organs.

Moreover, the requirement of donor "brain death" may have paradoxically *hindered* rather than facilitated the transplantation enterprise. There is good reason to believe that a significant factor contributing to the low rate of signing of organ donor cards has been a widespread instinctive suspicion that "brain dead" donors are really still alive (though fatally injured),[16] and that historically the "brain death" concept was manu-

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[12]Shewmon, *supra* note 4.

[13]Christiaan N. Barnard, *The Operation: A Human Cardiac Transplant: An Interim Report of a Successful Operation Performed at Groote Schuur Hospital, Cape Town*, 41 S. AFR. MED. J. 1271 (1967). *See also* Christiaan Barnard, *Reflections on the First Heart Transplant*, 72 S. Afr. Med. J., Dec. 5, 1987, at xix.

[14]Thomas E. Starzl et al., *Orthotopic Homotransplantation of the Human Liver*, 168 ANNALS SURGERY 392 (1968).

[15]Michael A. DeVita et al., *History of Organ Donation by Patients with Cardiac Death*, 3 KENNEDY INST. ETHICS J. 113 (1993).

[16]*See generally* Shewmon, *supra* notes 3 & 4; Halevy & Brody, *supra* note 5; Truog, *supra* note 5; Tom Tomlinson, *Misunderstanding Death on a Respirator*, 4 BIOETHICS 253 (1990); Stuart J. Youngner et al., *Psychosocial and Ethical Implications of Organ Retrieval*, 313 NEW ENG. J. MED. 321 (1985) [hereinafter *Psychosocial*]; Stuart J. Youngner et al., *'Brain Death'*

factured through "conceptual gerrymandering"[17] for purely utilitarian purposes.[18]

Concept of Death

Let us turn, then, to the key ontological question: Is a dead brain equatable with a dead person?

One must distinguish three levels of consideration, which are unfortunately often confused:[19]

(1) the *definition* of death—an essentially philosophical matter;
(2) the *anatomical criterion* which instantiates this definition—a hybrid philosophical/medical matter; and
(3) the *clinical signs or tests* to determine the occurrence of that anatomical criterion in concrete cases—a purely medical matter.

The United States vs. United Kingdom debate is at the second and third levels, whereas this article will focus on the first and second. After all, what good are valid diagnostic criteria for an invalid concept?

Three distinct concepts of death run throughout the "brain death" literature:[20]

(1) *Sociological: loss of conferred membership in human society*—an arbitrary, culturally relative, social construct, which presently happens to be brain based. Clearly this is *incompatible* with the Judeo-Christian view of human life and death.
(2) *Psychological: loss of essential human properties or personhood,* independent of the vital status of the body. It is species-specific and applies to many cognitively disabled human beings apart from the "brain dead." It reduces personhood to consciousness, often in turn reduced to a material product or epiphenomenon of brain electrochemical activity. It is also clearly inimical to the Judeo-Christian view.
(3) *Biological: loss of integrative unity of the body.* This is species *non*-specific and corresponds to the ordinary understanding of "death." It is harmonious with the Judeo-Christian heritage and underlies the mainstream theory of "brain death."

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and Organ Retrieval: A Cross-Sectional Survey of Knowledge and Concepts Among Health Professionals, 261 JAMA 2205, 2209 (1989); Stuart J. Youngner, *Organ Retrieval: Can We Ignore the Dark Side?* 22 TRANSPLANTATION PROCEEDINGS 1014 (1990); Stuart J. Youngner, *Brain Death and Organ Transplantation: Confusion and its Consequences,* 60 MINERVA ANESTESIOLOGICA 611 (1994) [hereinafter *Confusion*].

[17]Youngner, *Defining Death, supra* note 5.

[18]SINGER, *supra* note 10.

[19]JAMES L. BERNAT, ETHICAL ISSUES IN NEUROLOGY 113-43 (1994).

[20]Shewmon, *supra* note 4.

According to the Aristotelian-Thomistic philosophical tradition, the principle of unity of any living thing is its *substantial form* or *soul.* In humans this also has a spiritual dimension, so that the principle of personhood is one and the same with the principle of substantial unity of the body. This view contrasts markedly with the Platonic notion of soul as a pure spirit "imprisoned" in the body, and with Descartes' equation of soul with a conscious mind and the body with an organic machine.

The formulation of soul as substantial form of the body was even dogmatically defined by the Catholic Church in 1312 at the Council of Vienna: "[W]hoever shall obstinately presume in turn to assert, define, or hold that the rational or intellective soul is not the form of the human body in itself and essentially must be regarded as a heretic."[21] This teaching has been reinforced in more recent Magisterial pronouncements[22] and particularly by Pope John Paul II in his address to the 1989 Working Group of the Pontifical Academy of Sciences: "[Death] 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."[23] The same concept of life-principle has been expressed in the secular arena, merely without reference to the term "soul" or to a spiritual dimension. For example: "We define death as the permanent cessation of functioning of the organism as a whole . . . . [that is] [T]he spontaneous and innate activities carried out by the integration of all or most subsystems . . . and at least limited response to the environment."[24]

This view of the nature of human life carries two immediate consequences:

(1) if there is a live human body, there is *ipso facto* a live human person, and

(2) unconsciousness *per se,* even if irreversible, is ontologically a cognitive disability, not death.

Thus, a brain lesion can paralyze the intellectual and volitional faculties of the soul—can prevent their activation or realization—without necessarily causing the soul to cease informing the body as its life-principle. The

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[21]HENRY DENZINGER, THE SOURCES OF CATHOLIC DOGMA [ENCHIRIDION SYMBOLORUM] 190, ¶ 481 (Roy J. Deferrari trans., 13th ed., 1957).

[22]Pope Pius X, *Doctoris Angelici*, 6 ACTA APOSTOLICAE SEDIS 336 (1914); Pope Pius XI, *Studiorum Ducem*, 15 ACTA APOSTOLICAE SEDIS 309 (1923); Pope Pius XII, *Humani Generis*, 42 ACTA APOSTOLICAE SEDIS 561 (1950).

[23]Pope John Paul II, *Determining the Moment of Death, Address of Pope John Paul II to Participants in a Congress on the Determination of the Moment of Death (December 14, 1989)*, 35 POPE SPEAKS 207, 209 (1990).

[24]James L. Bernat et al., *On the Definition and Criterion of Death*, 94 ANNALS INTERNAL MED. 389, 390 (1981).

transition from life to death is marked rather by empirical signs that the "body" is no longer in fact a body, i.e., a dynamically integrated whole.

1995 United Kingdom Concept of Death

In this light let us examine the definition of death officially endorsed in 1995 by the Conference of Medical Royal Colleges[25] and elaborated on in Pallis and Harley's *ABC of Brainstem Death*:[26]

> We consider human death to be a state in which there is irreversible loss of the capacity for consciousness combined with irreversible loss of the capacity to breathe spontaneously (and hence to maintain a spontaneous heart beat). Alone, neither would be sufficient. Both are essentially brainstem functions . . . . The concept is, admittedly, a hybrid one, expressing philosophical, cultural, and physiological concerns. The loss of the capacity for consciousness can be thought of as a reformulation (in terms of modern neurophysiology) of the older cultural concept of the departure of the 'conscious soul' from the body. In the same perspective, irreversible apnoea can also be thought of as the permanent loss of 'the breath of life.'

This statement is remarkable for at least eight reasons. *First,* apneic coma as a *concept of death* is completely idiosyncratic, pulled out of philosophical thin air. (If apneic coma had been proposed rather as a diagnostic *criterion* for some reasonable concept, that would have been a different story; however, as it stands, the authors state in no uncertain terms that they "consider human death *to be* . . . [apneic coma].")

Second, the United Kingdom seems unable to make up its mind about fundamental concepts. In 1976, the Conference described the significance of a dead brainstem as essentially *prognostic*.[27] Three years later, it *equated* this with death, offering no reason except that it supposedly marked a "point of no return" in the process of dying (an *implicit* integrative-unity rationale).[28] The new *explicit* concept of apneic unconsciousness is therefore completely unrelated to the earlier explanations. Moreover, Pallis and Harley continue to emphasize imminent cardiac arrest as somehow of validating significance,[29] but that has no logical relationship with the new

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[25]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*, 29 J. ROYAL C. PHYSICIANS LOND. 381 (1995).

[26]*See* PALLIS & HARLEY, *supra* note 1, at 3.

[27]Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagnosis of Brain Death*, 2 LANCET 1069 (1976).

[28]Conference of Medical Royal Colleges and their Faculties in the United Kingdom, *Diagnosis of Death*, 1 LANCET 261 (1979).

[29]PALLIS & HARLEY, *supra* note 1, at 28-33.

concept, which is merely a variation on the unacceptable loss-of-personhood-on-the-basis-of-loss-of-consciousness rationale.

Third, there is no reason why the new concept should require the *entire* brainstem to be dead or *all* brainstem reflexes to be absent, most of which have no bearing on either consciousness or breathing. Therefore, the United Kingdom is in the strange position of having a clinical diagnostic algorithm relevant to an earlier *implicit* concept of death but largely *irrelevant* to the present *explicit* concept of death.

Fourth, the new concept is not *uniquely* fulfilled by death of the brainstem. A patient in permanent vegetative state with diaphragmatic paralysis would meet the definition of apneic unconsciousness yet possess a perfectly intact brainstem.

Fifth, selective brainstem destruction does not constitute loss of the "capacity for consciousness" any more than destruction of an electrical outlet constitutes loss of a lamp's capacity for illumination. Patients comatose from pure brainstem lesions have been restored to consciousness by electrical stimulation of the reticular formation above the lesion.[30] If "brainstem death" is death, therefore, patients with pure brainstem destruction and such stimulation above it would have to be classified as "conscious corpses"!

Sixth, the "capacity to breathe spontaneously" is *not* a prerequisite for "maintain[ing] a spontaneous heart beat," as implied by Pallis and Harley. Ventilator-dependent patients maintain spontaneous heart beats perfectly well. The heart possesses its own intrinsic pacemaker, and its prerequisite for spontaneous beating is oxygenated blood. *How* the blood becomes oxygenated is quite irrelevant.

Seventh, Pallis and Harley's reference to "the conscious soul" "departing" from the body is a Cartesian caricature of the perennial philosophical principle, disdainfully dismissed as an "older cultural" concept of death.

Eighth, the phrase "breath of life" is poetry, not physiology.

In summary, the *concept* of death officially endorsed in the United Kingdom is quite unrelated to the standard use of the word, rests on flimsy philosophical ground, is incompatible with the Judeo-Christian tradition, and ironically even lacks any coherent relationship with the clinical entity of "brainstem death," of which it is supposed to be the rationale.

Anatomical Criterion for Death

Let us, then, accept loss of somatic integrative unity as the concept of death and examine the empirical evidence whether destruction of the entire

[30]R. Hassler, *Basal Ganglia Systems Regulating Mental Activity*, 12 INT'L J. NEUROLOGY 53 (1977).

brain instantiates that concept. If not, then *a fortiori* neither does destruction of only the brainstem.

Invariably Imminent Cardiac Arrest

One important line of evidence is related to the supposed inability of the "brain dead" body to maintain stable cardiovascular function in the absence of the coordinating influence of the brain (specifically of the brainstem), suggesting that such a body is no longer really a true body but merely a disunited collection of organs. As Pallis wrote in 1983 and has been repeating ever since: "Asystole invariably develops [within a few days]. . . . The reasons why the heart stops within a short while . . . are complex but the empirical fact is established beyond all doubt."[31] Similarly, the 1981 U.S. President's Commission stated: "Even with extraordinary medical care, these [somatic] functions cannot be sustained indefinitely—typically, no longer than several days."[32] Similar quotations could be recited *ad nauseam* from the "brain death" literature, right up to the present time.[33]

Such assertions reduce to the following implicit syllogism:

- All bodies without integrative unity necessarily deteriorate inexorably to imminent cardiovascular collapse despite all therapeutic measures.
- All "brain dead" bodies necessarily deteriorate inexorably to imminent cardiovascular collapse despite all therapeutic measures.
- Therefore, all "brain dead" bodies lack integrative unity.

This would be a good argument . . . if only the facts were correct and the logic valid. Re-expressed symbolically, it runs:

- All X have property Y.
- All Z have property Y.
- Therefore, all Z are X.

But the illogic matters little anyway, for the minor premise is not even true. The correct syllogism really is:

- All X have property Y.
- Not all Z have property Y.

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[31]Christopher Pallis, *Whole-Brain Death Reconsidered - Physiological Facts and Philosophy*, 9 J. Med. Ethics 32, 35-6 (1983).

[32]PRESIDENT'S COMM'N FOR THE STUDY OF ETHICAL PROBLEMS IN MEDICINE & BIOMEDICAL AND BEHAVIORAL RESEARCH, DEFINING DEATH: A REPORT ON THE MEDICAL, LEGAL, AND ETHICAL ISSUES IN THE DETERMINATION OF DEATH 35 (1981) [hereinafter PRESIDENT'S COMM'N].

[33]D. Alan Shewmon, *Chronic "Brain Death:" Meta-Analysis and Conceptual Consequences*, 51 NEUROLOGY (Dec. 1998).

- Therefore, at least some Z are not X.

Prolonged Survivals in "Brain Death"

Some 159 "brain death" cases with survival of one week or more have been published in the medical literature, many involving children or pregnant women whose support was maintained either on account of parental insistence or to save the fetus. Four more have come to my attention through other neurologists and two through personal experience. Ten additional cases have been reported in the news media. Clinical details and complete references have been compiled in two extensive tables accompanying a forthcoming publication.[34] Most of these cases involved "whole brain death," often confirmed by the absence of brain waves or intracranial blood flow; the rest fulfilled U.K. brainstem criteria.

Of the total ~175 cases with survival of at least one week, ~80 survived at least two weeks, ~44 at least four weeks, ~20 at least two months, seven at least six months, and four longer than one year, the record being fifteen years (and still going)!

Given that most of these cases are public domain, it is difficult to understand how Pallis and Harley, as recently as 1996, could claim with straight faces:

> What was clearly established in the early 1980s was that *no patient* in apnoeic coma declared brain dead according to the very stringent criteria of the United Kingdom code . . . *had ever failed to develop asystole within a relatively short time.* That fundamental insight remains *as valid today as it was 20 years ago*—and not only in the United Kingdom but *throughout the world.*[35]

A prime example, it would seem, of filtering the facts to fit the theory.

Fifty-six of the total ~175 cases had sufficient individual information available for statistical meta-analysis to elucidate factors influencing survival capacity. One important determinant proved to be age. The longest survivors (two years, seven months; five years, one month; and fourteen years, five months) were all young children, and all nine survivors beyond four months were below eighteen years old. Conversely, all seventeen patients over age thirty survived less than two and a half months.

Another key determinant of survival capacity was the *cause* of "brain death." Etiologies were divided into two categories: primary brain pathology (such as spontaneous intracranial hemorrhage or gunshot wound to the head) and diffuse or multisystem damage (such as cardiac arrest or motor vehicle accident). That the latter should impair survival more than

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[34]*Id.*

[35]PALLIS & HARLEY, *supra* note 1, at preface (emphasis added).

the former makes intuitive sense and was verified statistically by comparing the respective survival curves.

These data teach us several lessons: (1) "Brain death" does *not* necessarily lead to imminent cardiac arrest despite all treatment. (2) The heterogeneity of survival duration is largely explainable by non-brain factors. Moreover, the *process* of brain damage *leading up* to "brain death" frequently induces secondary damage to heart and lungs. Therefore, the tendency to early cardiac arrest in the majority of patients is attributable more to *somatic* factors than to mere absence of brain activity *per se*. (3) The first few weeks are especially precarious. But those who make it through tend to stabilize, no longer requiring sophisticated technological support. Some have even been discharged home on a ventilator. Although some personhood-consciousness reductionists might try to argue that these are not human *persons*, no one can seriously claim that they are not living human *organisms*, living human *beings*.

Let me introduce you to T.K., the record survivor. At age four he contracted meningitis, causing such intracranial pressure that even his skull bones split. Multiple brain-wave tests have been flat, and no spontaneous respirations or brainstem reflexes have been observed over the subsequent fifteen years. Physicians suggested discontinuing support, but his mother would not hear of it. His early course was very rocky, but eventually he was transferred home, where he remains on a ventilator, assimilates food placed in his stomach by tube, urinates spontaneously, and requires little more than nursing care. While "brain dead" he has grown, overcome infections, and healed wounds.

T.K.'s mother gave me permission to examine him and to document everything photographically. I was satisfied that he had no brainstem function. The skin of his face and upper torso did, however, become mottled in response to my pinching parts of his body, associated with a rise in heart rate and blood pressure. This spinally mediated stress response could not be elicited from the face, sensory input from which is processed in the brainstem, which in him is missing.

Further confirming the diagnosis, evoked potentials showed no cortical or brainstem responses, a magnetic resonance angiogram showed no intracranial blood flow, and an MRI scan revealed that the entire brain, including the brainstem, had been replaced by ghost-like tissues and disorganized proteinaceous fluids.

T.K. has much to teach about the necessity of the brain for somatic integrative unity. There is no question that he became "brain dead" at age four; neither is there any question that he is still alive at age nineteen.

Litany of integrative functions

Another common argument for equating "brain death" with death is to recite a litany of brain-mediated integrative functions and exclaim, "How can a 'brain dead' body possibly be a unified organism without all these?" Take, for example, the following statement by Bernat:

> [I]t is primarily the brain that is responsible for the functioning of the organism as a whole: the integration of organ and tissue subsystems by neural and neuroendocrine control of temperature, fluids and electrolytes, nutrition, breathing, circulation, appropriate responses to danger, among others. The cardiac arrest patient with whole brain destruction is simply a preparation of unintegrated individual subsystems, since the organism as a whole has ceased functioning.[36]

But mere function-listing of this sort is not a very scientific approach to an essentially empirical question. To determine whether a given body has integrative unity (hence, is a body as opposed to a collectivity of organs), one must first *define the term* and then examine that body for *properties relevant to the definition.* Surprisingly, despite the vastness of the "brain death" literature and the import of the question, this has never been done. I therefore propose the following two operational definitions or criteria:

> *Criterion 1.* "Integrative unity" is posessed by a putative organism (i.e., it really *is* an organism) if the latter possesses at least one emergent, holistic-level property. A property of a composite is defined as "emergent" if it derives from the mutual interaction of the parts, and as "holistic" if it is not predicable of any part or subset of parts but only of the entire composite.

Healthy living organisms typically possess many such properties, whereas a sick organism might possess fewer. But only one suffices for it to *be* an organism, for if the property is truly at the level of the whole, there must be a whole of which it is predicated.

The second operational criterion is a corollary:

> *Criterion 2.* Any body requiring *less* technological assistance to maintain its vital functions than some other body that is nevertheless a living whole must possess at least as much robustness of integrative unity and hence also be a living whole.

Clearly many "brain dead" bodies in intensive care units require less technological support than many other extremely sick or dying patients in those same units, who are nevertheless considered by all as alive (e.g., someone with heart, kidney and liver failure, in shock from a fungal blood

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[36]James L. Bernat, *The Definition, Criterion, and Statute of Death*, 4 SEMINARS NEUROLOGY 45, 48 (1984).

infection, on a ventilator, a cardiac-assist pump and hemodialysis, with countless catheters and tubes in every imaginable vein, artery and orifice, requiring twenty different medications, constant blood sampling, etc.). *Ergo*, those "brain dead" patients, with even *more* integration, must also be alive.

But let us return to the litany of integrative functions in light of Criterion 1. On closer inspection,[37] one discovers that, surprisingly,

- most *brain-mediated* integrative functions are not *somatically integrating*, and conversely,
- most somatically integrating functions are not brain-mediated.

Moreover, some key "integrative functions," if understood as *brain-mediated*, are not *somatically integrating*, and if understood as *somatically integrating*, are not *brain-mediated*.

Take, for example, breathing and nutrition, cited by Bernat in the quotation several paragraphs above. If "breathing" is understood as moving air in and out of the lungs, it is a function of the diaphragm coordinated by the brainstem. If, however, it is understood as "respiration," in the technical sense of exchange of oxygen and carbon dioxide (more relevant to integrative unity), then it is a chemical function of the mitochondria in every cell of the body. (In fact, the final series of macromolecules involved in the generation of energy from oxidative burning of chemical fuel is known as the "respiratory chain".)

Similarly, if "nutrition" is understood as eating, it is a function of the mouth and pharynx coordinated by the brain. If, however, it is understood as the breakdown and assimilation of nutrients for energy and bodily structure (the only sense relevant to somatic integration), then it is both a function of the gastrointestinal tract and a chemical function of every cell throughout the body.

Here is another irony. Although neurologists often cite the supposed imminence of cardiovascular collapse to justify equating "brain death" with death, the American Academy of Neurology's recent diagnostic guideline states that "*[n]ormal* blood pressure *without* pharmacologic support" is explicitly "*compatible* with the diagnosis of brain death."[38] Moreover, heart transplant surgeons agree that "most donors *can be withdrawn successfully*

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[37] D. Alan Shewmon, *The Brain and Somatic Integration: Insights Into the Standard Biological Rationale for Equating "Brain Death" with Death*, J. MED. & PHIL. (forthcoming 1999).

[38] American Academy of Neurology, Quality Standards Subcommittee, *Practice Parameters for Determining Brain Death in Adults (Summary Statement)*, 45 NEUROLOGY 1012, 1013 (1995) (emphasis added).

from [pharmacologic] support with vigorous volume resuscitation,"[39] and that cardiovascular *stability* is a relative *requirement* for heart donation candidacy.[40] In other words, the very feature intended to assure us that heart donors are dead is itself a contraindication to heart donation; and conversely, the best hearts for transplantation come from donors with intrinsic somatic integration not deriving from the brain and who are therefore alive despite being "brain dead."

Further, although the mainstream *rationale* for equating "brain death" with death (at least in the United States) is the loss of integrative unity,[41] the official *diagnostic criteria* (1) do not require *absence* of a single somatically integrating brain function, and (2) explicitly allow *preservation* of some somatically integrating functions (for example, hypothalamic / posterior pituitary function, cardiovascular stability, and autonomic and endocrine stress responses to skin incision).[42]

Further still, there is an impressive parallel litany of non-brain-mediated somatically integrative functions, most (if not all) of which are holistic properties fulfilling Operational Criterion 1. These include:[43]

- homeostasis of a limitless variety of physiological parameters and chemical substances;
- assimilation of nutrients;
- elimination, detoxification and recycling of cellular wastes;
- energy balance;
- maintenance of body temperature (albeit subnormal);
- wound healing;
- fighting of infections and foreign bodies;
- development of a febrile response to infection (albeit rarely);
- cardiovascular and hormonal stress responses to incision for organ retrieval;
- successful gestation of a fetus (as in thirteen pregnant women of the prolonged survivors);
- sexual maturation (in two prolonged-surviving children);

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[39]Joseph M. Darby et al., *Approach to Management of the Heartbeating 'Brain Dead' Organ Donor*, 261 JAMA 2222, 2225 (1989) (emphasis added) (citation omitted).

[40]*Id. See also* William Graham Guerriero, *Organ Transplantation*, in NEUROTRAUMA 835-40 (Raj K. Narayan et al. eds., 1996).

[41]PRESIDENT'S COMM'N, *supra* note 32.

[42]American Academy of Neurology, *supra* note 38.

[43]Shewmon, *supra* notes 33 & 37.

- and proportional growth (in three children).

In addition to fulfilling Operational Criterion 1, the following non-brain-mediated manifestations of integration also fulfill Criterion 2:

- recovery and stabilization following cardiac arrest and other complications (at least in some cases);
- spontaneous improvement in general health, such as loss of the need for pressor drugs to counteract hypotension, return of gastrointestinal motility (allowing tube feedings), etc.;
- ability to maintain fluid and electrolyte balance with rare or no serum monitoring and rare or no adjustment of fluid volume and composition; and
- the overall ability to survive with little medical intervention outside a hospital (as in seven of the prolonged survivors).

Why should all these non-brain-mediated functions be selectively ignored, when they are more truly somatically integrating than the brain-mediated ones?

Far from constituting a "central integrator," without which the body reduces to a mere bag of organs, the brain serves as modulator, fine-tuner, optimizer, enhancer, and protector of an implicitly *already existing, intrinsically mediated* somatic unity. Integrative unity is *not* a top-down imposition from a "central integrator" on an otherwise unintegrated collection of organs. (If it were, even the healthy body would lack *true* unity, but would rather consist of a brain carried around and kept alive by dictatorially micromanaged body parts.) Rather, it is a *non-localized, holistic property* founded on the mutual interaction among all the parts of the body.

Brain-body disconnection and brain destruction—somatic equivalence

If the foregoing considerations have been insufficiently convincing that a "brain dead" body is a living human organism, there is a final trump card that seems to me definitive. It is explained somewhat in a recent article[44] and extensively in another paper devoted entirely to the topic.[45] In broad strokes the argument runs as follows.

If the body's integrative unity depended on brain functioning, then the body should fall apart just as surely from functional disconnection from the brain as from destruction of the brain. The brain exerts its coordinating role over the body through basically three anatomical pathways: the spinal cord,

[44]Shewmon, *supra* note 4.

[45]D. Alan Shewmon, "Brain Death" as Spinal Shock: Somatic Pathophysiological Equivalence and Implications for the Integrative-Unity Rationale (submitted for publication).

the vagus nerve, and the pituitary gland. "Brain death" with relatively intact pituitary function (as is often the case) should therefore have the same effect on somatic physiology as high cervical cord transection plus pharmacologic ablation of the vagus nerve. Or for a more striking analogy, one could suppose that the spinal injury victim was an endocrinology patient with chronic hypopituitarism, stable on hormonal replacement therapy. Thus, the somatic pathophysiology of high spinal cord transection can be made virtually *identical* to that of "brain death" (the *only* difference being that in spinal cord injury consciousness and cranial nerve functions are preserved but in "brain death" they are not—a difference highly important for the patient but irrelevant to the question at hand, namely whether brain function is necessary for the body's integrative unity).

The tendency to acute cardiovascular instability, the hypothermia and other symptoms of "spinal shock," the subsequent stabilization of those who survive the acute period, and the eventual return of autonomous spinal cord function—all these characterize both conditions equally. In fact, one can take a typical book chapter on the intensive care of "brain dead" organ donors and a typical chapter on the intensive care of high spinal cord injury victims and essentially transform the one into the other merely by switching the terms "brain death" and "spinal cord injury."

Now, if everyone recognizes that the body of the high cervical cord transection victim is alive despite its lack of regulation by the brain, why should not the same be said of a "brain dead" body, which is in an identical physiological state (again, the issue of consciousness aside)? The prevailing interpretive double standard is intellectually schizophrenic and should be rejected.

What *is* death, if not "brain death"?

But if "brain death" is not death, what is? We orient once again to the three conceptual levels: definition, anatomical criterion, and clinical tests.

Now, the basic *definition* remains precisely what we have been discussing all along: the loss of integrative unity of the body.

The *anatomical criterion,* however, shifts from a single locus (the brain) to the entire body and consists in a critical degree of molecular-level damage (not yet grossly detectable) throughout the body, beyond a thermodynamical "point of no return." The body's intrinsic tendency to active, anti-entropic self-development and self-maintenance (of the essence of "life") is irretrievably lost, so that physico-chemical processes now follow the path of increasing entropy characteristic of inanimate things (i.e., decay). This does *not* require supracritical damage of every single cell in the body, but rather supracritical damage of enough cells of enough different types that the body as a whole loses its intrinsic ability to counteract

entropy (and thus, in principle, would continue to "dis-integrate" even if hypothetically forcibly perfused mechanically by oxygenated blood).

The *clinical tests* correspondingly shift from those implying loss of brain function to those implying thermodynamically supracritical microstructural damage diffusely throughout the body. Now a *sine qua non* of the opposition to entropy is energy, generated by chemical respiration, and a *sine qua non* of somatic integration is the circulation of blood, by means of which the body parts mutually interact. A clinical test for the "point of no return" is therefore sustained cessation of circulation of oxygenated blood. The critical duration of cessation depends greatly on body temperature; under ordinary circumstances (i.e., normal temperature), an educated guess is that twenty to thirty minutes probably suffice to surpass the "point of no return."

Although "circulatory-respiratory" sounds similar to the old-fashioned phrase "cardio-pulmonary," they are not synonymous. Neither spontaneous heartbeat nor breathing through the lungs is essential for life (as cardiopulmonary bypass machines effectively prove), but circulation and chemical respiration *are*. Thus, the proposal of a circulatory-respiratory standard represents, far from a reactionary regression, actually a conceptual advance, bringing our criterion and tests for death more in line with the basic concept. Because chemical respiration is contingent on the circulation of oxygenated blood, this dual criterion really boils down in practice to the single one of cessation of circulation beyond a thermodynamical "point of no return" (again, after probably some twenty to thirty minutes under ordinary circumstances).

Conclusion

In summary, the notion of "brain death" as bodily death turns out to be logically and physiologically incoherent. Historically, the introducers of "brain death" intended a radical redefinition of death in terms of loss of personhood by virtue of permanent unconsciousness, for the purely utilitarian purposes of turning off ventilators and organ transplantation.[46] Ironically, a redefinition of death was completely unnecessary for either purpose.

But—one might legitimately ask—even if "brain death" *is* a legal fiction, it has produced much good and no apparent harm. To eliminate it at this point would entail a major medical, legal, and social upheaval. Why not just let it be? I see five reasons.

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[46]Shewmon, *supra* note 4; Singer, *supra* note 10.

First, many professionals involved in transplantation do not really believe that "brain dead" donors are dead.[47] Thus, consciences may be compromised by a subliminal sense of participation in utilitarian killing. Moreover, the widespread perception that society approves the killing of certain moribund patients for a good enough cause (or that it approves legally defining some powerless live human beings as "non-persons," if so doing sufficiently benefits those empowered to selectively define themselves as "persons")—all made morally palatable through the guise of a legal fiction of "death"—such a perception may be contributing to the general erosion of respect for the sanctity of life.[48] The evisceration of live patients with destroyed brains could thereby be causing much more harm to doctors, nurses and society than to the organ donors themselves.

Second, the mainstream physiological rationale for "brain death" has become increasingly implausible. But as "brain death" is falsely regarded as a bioethical sacred cow that must be preserved at all costs, theorists have been turning increasingly to the only remaining coherent rationale, namely loss of personhood in the materialistic-reductionistic sense. Consequently, "brain death" praxis is beginning to evolve in a direction consistent with *that* notion and *inconsistent* with the sanctity of human life. For example, proposals to use *live* anencephalic infants or patients in a "persistent vegetative state" as organ sources, unthinkable only a few years ago, are now taken seriously among the intelligentsia and in the medical literature.[49]

Third, the notion of "brain death" has inspired the invention of its supposed mirror image, so-called "brain life," as a justification for abortion

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[47]Shewmon, *supra* notes 3 & 4. *See also* Tomlinson, *supra* note 16; *Psychosocial*, *supra* note 16; *Confusion*, *supra* note 16; P. Castelnuovo-Tedesco, *Cardiac Surgeons Look at Transplantation—Interviews with Drs. Cleveland, Cooley, DeBakey, Hallman and Rochelle*, 3 SEMINARS PSYCHIATRY 5 (1971).

[48]P. JOHN PAUL II, THE CATHOLIC CHURCH, EVANGELIUM VITAE [THE GOSPEL OF LIFE] ¶ 15 (1995).

[49]*See* Halevy & Brody *supra* note 5; Singer, *supra* note 10, at 38-56; *Plea for Lethal Jabs to Save Coma Organs*, DAILY TELEGRAPH (London), Nov. 1, 1997; Council on Ethical and Judicial Affairs, American Medical Association, *The Use of Anencephalic Neonates as Organ Donors*, 273 JAMA 1614 (1995); Diane M. Gianelli, *AMA Organ Donor Opinion Sparks Ethics Debate: Should Anencephalic Infants be 'Living Donors'?* AM. MED. NEWS, July 25, 1994, at 1, 13, 14; L.P. Ivan, *The Persistent Vegetative State*, 22 TRANSPLANTATION PROCEEDINGS 993 (1990); Howard H. Kaufman, *Brain Death Following Head Injury*, *in* NEUROTRAUMA 819, 820 (Raj K. Narayan et al. eds., 1996); Frank A. Oski et al., *Ethical Dilemma: Should Organs Be Taken From This Patient?* 4 CONTEMP. PEDIATRICS 110 (1987) (edited discussion); Kirk Payne et al., *Physicians' Attitudes About the Care of Patients in the Persistent Vegetative State: A National Survey*, 125 ANNALS INTERNAL MED. 104 (1996); David J. Powner et al., *Medical Diagnosis of Death in Adults: Historical Contributions to Current Controversies*, 348 LANCET 1219 (1996); S. Schneider, *Traditional Transplant Standards Don't Apply to Anencephalic Organ Donation*, AM. MED. NEWS, Feb. 19, 1996, at 21 (Letter to the Editor).

and human embryo experimentation.[50] Although the "brain life" idea is contradicted by physiological considerations of integrative unity (nothing is more clearly an "organism as a whole" than a developing embryo, despite absence of a brain), it *does* logically follow from the reductionistic consciousness-personhood approach, which is gradually becoming the unofficial but *de facto* rationale for "brain death."

Fourth, there is a serious issue of informed consent.[51] Most signers of organ donor cards and families authorizing donation have very little understanding of "brain death" and what actually happens in operating rooms. When they read the phrase "after my death," many imagine a pulseless corpse and might be horrified to learn that it really means "after I become comatose and apneic but all my other organs are working fine," and that "I will be eviscerated while still pink and warm, with my heart still spontaneously beating and blood circulating." Moreover, no one is informed that the rationale for equating "brain death" with death remains controversial and that empirical evidence has been accumulating that casts serious doubt on the mainstream rationale. Thus, information highly relevant for the potential donor's moral decisionmaking is systematically withheld.

Finally, for the state to define someone as legally dead according to a criterion contrary to that person's deeply held convictions violates freedom of religion or other fundamental rights. (I am thinking particularly of orthodox Jews but also of anyone who rejects "brain death" even for non-religious reasons.) So far, only the state of New Jersey has shown itself sensitive to these rights by introducing into its "brain death" statute a "conscience clause" exempting those who want their own deaths diagnosed the traditional way.[52] This has given rise to the bizarre anomaly whereby one patient with a destroyed brain could be legally dead while another patient in exactly the same condition be legally alive—or whereby a patient could be legally dead in New York, driven across the bridge to New Jersey, and suddenly statutorily resurrect. Only a circulatory-respiratory statutory definition has the potential for universal acceptance, without compromising any rights of those who believe that death is brain-based (their ventilators

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[50]Fritz K. Beller & Julia Reeve, *Brain Life and Brain Death—The Anencephalic as an Explanatory Example: A Contribution to Transplantation*, 14 J. MED. & PHILOSOPHY 5 (1989); D. Gareth Jones, *Brain Birth and Personal Identity*, 15 J. MED. ETHICS 173 (1989); Hans-Martin Sass, *Brain Life and Brain Death: A Proposal for a Normative Agreement*, 14 J. MED. & PHILOSOPHY 45 (1989).

[51]*Cf.* David W. Evans, *Brain Stem Death—A Deception*, PHILOSOPHY TODAY, Jan. 1993, at 1 [The newsletter of The Society for Applied Philosophy, United Kingdom].

[52]*See* Veatch, *supra* note 5. *See also* Robert S. Olick, *Brain Death, Religious Freedom, and Public Policy: New Jersey's Landmark Legislative Initiative*, 1 KENNEDY INST. ETHICS J. 275 (1991).

could still be discontinued and they could still donate organs through a non-heart-beating donor protocol).

These, then, are my reasons for challenging "brain death" dogma. And I am convinced that its replacement by something scientifically more credible would promote not only the sanctity of life, but ironically perhaps even transplantation as well.