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Are Organ Donors after Cardiac Death Really Dead?

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Organ donation after cardiac death (DCD), formerly called non-heart-beating organ donation, has become a widespread practice in the United States over the past decade.¹ Although DCD was practiced in the 1950s and 1960s before the brain-death era, thereafter it was discarded in favor of the heart-beating brain-dead organ donor. Brain-dead patients were superior organ donors because mechanical ventilation and maintained circulation permitted their continued organ perfusion and oxygenation until the moment of organ procurement. In the early 1990s, in response to the growing demand for organs to transplant, and in response to the desires of the families of patients who were brain-damaged, but not brain-dead, that these patients be removed from life-sustaining therapy in ICUs, and to have their loved ones serve as organ donors, the University of Pittsburgh Medical Center established the first modern DCD program.²

Since then, greater numbers of organ procurement organizations (OPOs) have encouraged the creation of DCD programs so that, currently, approximately half of the OPOs in the U.S. permit DCD.³ The growth and acceptance of DCD programs was spurred by two influential reports from the Institute of Medicine in 1997 and 2000, which concluded that DCD was legitimate and desirable, and hospitals should be encouraged to implement DCD protocols.⁴ In 2004, the former secretary of the U.S. Department of Health and Human Services, Tommy Thompson, publicly encouraged further growth of DCD programs.⁵

But, from the beginning, the practice of DCD has been dogged by an unresolved controversy over its conceptual foundation: are organ donors truly dead when they are declared dead after five minutes⁶ of asystole?⁷ Several scholars have argued that DCD patients are not dead after five minutes of asystole,⁸ and have criticized the Institute of Medicine for sidestepping this critical question.⁹ I will argue here that whether DCD patients are actually dead or should be considered as dead after five minutes of asystole turns on the distinction between the concepts of "irreversible" and "permanent" loss of vital functions. I then consider whether it constitutes prudent public policy to permit substituting "permanent" for "irreversible" in the test for death using a cardiopulmonary criterion.

THE PROBLEM INHERENT IN DCD DEATH DETERMINATION

DCD protocols permit a hopelessly dying, ventilator-dependent patient (or, more commonly, his or her legally authorized surrogate) to consent to organ donation after death, once further life-sustaining therapy has been refused and discontinued. In the most common case, the patient has sustained profound brain damage from trauma, stroke, or cardiac arrest, that creates ventilator dependency and offers no hope for

meaningful neurological recovery. Such a patient does not meet brain-death criteria, but is hopelessly ill because of profound brain damage, with a very poor prognosis. Based upon the patient's prior wishes for stopping treatment in light of the poor prognosis, the family then refuses further life-sustaining therapy on behalf of the patient to permit him or her to die. They also request or consent to organ donation after death.

DCD protocols coordinate the timing of withdrawing the ventilator with the organ procurement team's readiness to procure organs. Once withdrawn from the ventilator, patients usually cannot breathe at all or breathe insufficiently to maintain life.¹⁰ As the patient's oxygenation rapidly declines, the heartbeat then stops from lack of oxygen. After five minutes of absent heartbeat, the patient is declared dead and rushed to the operating room where organ procurement is rapidly performed, usually yielding transplantable kidneys, liver, and occasionally other organs.

Skeptics have criticized DCD protocols on several grounds, but the most serious claim is that the patient is dying but is not yet dead after only five minutes of asystole.¹¹ What if the heart could be restarted at that point, and, with restored circulation, the brain retains some degree of function? The patient then would not be considered dead, using either a brain or a cardiopulmonary criterion. If a patient could be resuscitated after five minutes of asystole, then clearly the patient was not dead at that point, because the cessation of brain function would not have been irreversible, a condition that is required by both the concept and statute of death.

Supporters of DCD counter that the five-minute asystole practice is defensible on two grounds. First, there is firm empirical evidence that after five minutes of asystole resulting from apnea, DCD patients will not "auto-resuscitate," that is, they will not spontaneously regain heartbeat and circulation.¹² Second, no attempt will be made to artificially resuscitate the patients because the intent of withdrawing the ventilator was to permit them to die in accordance with their wishes. Therefore, whether they have the capacity to be resuscitated after five minutes of apnea and asystole is not a practical concern. Although these statements are true, a solely pragmatic defense without further analysis fails to address the principal issue.

THE STATUTE OF DEATH

In 1981, the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research advocated a brain-based death standard of death and proposed the Uniform Determination of Death Act (UDDA) as a model statute that it urged each state to adopt. In its relevant clause, the UDDA states: "An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead."¹³

Subsequently, nearly all states adopted the UDDA or a variation of it. In their influential work, *Defining Death*, the President's Commission defended the UDDA as the logical outcome of a unitary, brain-based concept of death.¹⁴ It held that any person with irreversible cessation of all brain functions was dead, irrespective of mechanically supported ventilation and circulation. It pointed out that this unitary death standard could be tested in two ways: using brain-death tests if the patient's ventilation was being mechanically supported, or by showing the cessation of circulatory and respiratory functions if ventilation was not being supported.

But in drafting the UDDA, the President's Commission erred in proposing a bifurcated legal criterion of death comprising two separate standards of death without explaining their relationship within the statute. My Dartmouth colleagues and I criticized the UDDA at the time for not articulating a single brain standard (as the President's Commission itself had argued in *Defining Death*), which could be simply tested by physicians in two ways, because it was clear that the tests showing the irreversible cessation of circulatory and respiratory functions were adequate tests of death only because they inevitably led to the irreversible cessation of all brain functions.¹⁵ Because patients who were successfully resuscitated prior to the complete loss of brain functions were not dead, the loss of all brain functions was the unitary criterion of death. Thus, despite the absence of this clarification within the UDDA, its seemingly separate bifurcated criteria are not independent.

The UDDA stipulates that the cessation of brain functions or of circulatory and respiratory functions must be irreversible. This reasonable requirement derives from the concept that death is, by definition, an irreversible state.¹⁶ Because no mortal can return from being dead, any resuscitation or recovery must have been from a state of dying, but not from death.¹⁷ Thus, the concept of irreversibility is intrinsic to the concept of death. But what precisely did the statute framers mean by "irreversible" when applied to cessation of organ functions? In the UDDA, the President's Commission did not define "irreversible."

THE DISTINCTION BETWEEN *PERMANENT* AND *IRREVERSIBLE*

In many analyses of the definition of death, the adjectives *permanent* and *irreversible* have been applied loosely and interchangeably in referring to the cessation of vital functions.¹⁸ At first hearing, they sound synonymous. But they have an important distinction that becomes especially relevant in determining the death of an DCD patient. The *Oxford English Dictionary* defines *irreversible* as "that cannot be undone, repealed, or annulled; irrevocable."¹⁹ Thus, a loss of a function can be said to be irreversible if that function cannot possibly be regained spontaneously or restored through intervention. *Irreversible* is an absolute and univocal statement that reflects the physical reality of immutability, a condition that exists independently of our intent or action. By contrast, the *OED* defines *permanent* as "continuing or designed to continue indefinitely without change; abiding, lasting, enduring, persistent (opposed to 'temporary')."²⁰ Thus, a loss of function can be said to be permanent if that function will not become restored either spontaneously or through intervention. *Permanent* is an equivocal and contingent condition that permits possibility. It may rely on our intent and action to be realized, and does not refer directly to a possibility of reversal.²¹

Despite their distinct definitions, a spatial and temporal relationship exists between the sets of permanently and irreversibly lost functions. The set of permanently lost functions encompasses the set of irreversibly lost functions. Thus, all functions that are irreversibly lost also are permanently lost, but not all functions that are permanently lost are necessarily irreversibly lost, at least at the moment that permanence is established.²² And all functions that are irreversibly lost first are permanently lost; that is, once a function becomes permanently lost, it quickly evolves to also being irreversibly lost.

The philosopher David Cole pointed out that the term "irreversible" is inherently ambiguous, because it belongs to a class of modal terms in the philosophy of language that resists consensus analysis.²³ Cole identified two principal construals of "irreversible" functions. The strong construal of the term means that the function cannot be restored by anyone under any circumstance at any time, now or in the future. The weak construal means that the function cannot be restored by anyone now, using available contemporary technology, but possibly may be able to be restored elsewhere now, where emerging technologies are available, or in the future with the development of new technologies. Thereafter, David Lamb pointed out that Cole's strong construal of irreversible (essentially, a return of functions that is logically impossible) fails the test of plausibility, and should be rejected when applied to the definition of death.²⁴

I agree with Lamb that the weak construal of *irreversibility* of vital functions is our intended usage in determining death. First, it is difficult to predict the capabilities and effects of future technologies, even to assess biological possibility. Second, the availability of unanticipated future technologies may alter the concepts in question, requiring a reanalysis at that time. For example, we may need to redefine human death if future technologies permit brain synthesis or brain transplantation. But, most importantly, the issue of death determination that is governed by a statute of death concerns the current possibility of the reversal of vital functions. As John Lizza recently pointed out, our use of *irreversibility* in a definition of death implicitly refers to practical and not logical factors about the physical state of the person.²⁵

In Cole's critique of the ambiguity of "irreversible," he explained that some scholars, in discussing DCD, have used the term in a third and an even weaker construal that corresponds to my usage of *permanent*.²⁶ In a later analysis of the question, "When is dead?" Stuart Youngner and colleagues further explored this weakest construal of *irreversibility* and noted that it means that the function may be potentially reversible, but that it will not reverse spontaneously or be restored therapeutically because physicians have de-

cided not to attempt to reverse it once it stopped. Youngner and colleagues criticized this weakest construal of *irreversible* because it was inconsistent and counter-intuitive, and failed to solve the DCD death issue.²⁷

Critics may question if parsing the words *irreversible* and *permanent*, as I have done, gains any conceptual ground or merely is a linguistic legerdemain that avoids the conceptual issue. I believe that clarifying terminology is a first step in studying the problem. Insisting upon a strong correspondence between the ordinary, consensual understanding of the words we use and the concepts to which they refer is critical in our analysis of complex biophilosophical concepts. It is inaccurate and misleading to classify the cessation of a function as *irreversible* (using the weakest construal of the word according to Cole and Youngner and colleagues) when it remains reversible. This usage fulfills Humpty Dumpty's claim in *Through a Looking Glass: And What Alice Found There*, that words can be made to mean whatever we want them to mean.²⁸ Although I agree with Lamb and Lizza's rejection of Cole's strong construal of *irreversibility* for the reasons they cited, the weakest construal falls outside the domain of *irreversibility* altogether, and resides properly within the domain of *permanence*. I explore later how reclassifying the weakest construal of *irreversibility* as *permanent* is relevant to death determination in DCD.

Although *permanent* and *irreversible* are separable concepts, they have a causal relationship that is of particular importance when applied to the loss of circulatory and respiratory functions. Once the loss of these functions has been determined to be permanent, it rapidly and inevitably progresses to become irreversible during the minutes it takes for the brain to be destroyed by lack of oxygen and blood flow. Thus, *permanence* in this context represents an earlier stage of an inevitable process that rapidly and with complete certainty yields *irreversibility*. *Permanence* is the absolute prognosis of *irreversibility*.

In the DCD context, after five minutes of apnea and asystole, given the empirical data showing no occurrences of auto-resuscitation, and based on physicians' respect of the patient's wishes not to be mechanically resuscitated, it is clear that the patient's circulatory and respiratory functions have ceased *permanently*, even though they may not yet have ceased *irreversibly*. The following prudential question then is raised: is permanence of the cessation of circulatory and respiratory functions a sufficient condition for a death test without also requiring irreversibility?

DETERMINING DEATH IN CLINICAL PRACTICE

One way to address this question is to inspect how physicians commonly employ the test showing the absence of circulatory and respiratory functions in their clinical practice of determining death outside the DCD circumstance. Let us consider the common clinical example of a hospitalized patient dying of widely metastatic cancer who is receiving palliative care and is expected to die within a few days. On 6:00 a.m. hourly rounds, a nurse finds the patient without breathing or heartbeat. The intern is summoned to declare death. Her examination discloses a motionless patient who is not breathing, has no pulse or heartbeat, and whose pupils do not react to light. She declares the patient dead at the time of her examination at 6:04 a.m. The patient was last seen alive during 5:00 a.m. rounds. The patient could have lost heartbeat and breathing at any time between 5:00 and 6:00 a.m., including at 5:59 a.m. The question is whether the patient's documented absence of circulatory and respiratory functions is irreversible at the time the intern declared death at 6:04 a.m., given that the statute of death requires irreversible cessation of these functions.

In clinical practice, declaration of death using the test for cessation of circulatory and respiratory functions almost never requires showing that the cessation of functions is irreversible. It requires showing only that the cessation of functions is permanent. The dying patient portrayed above certainly has permanently lost circulatory and respiratory functions, because we know from data and experience that once breathing and heartbeat cease in a patient dying of widely metastatic cancer, they do not spontaneously restart. Further, we know that because the patient has a DNR (do-not-resuscitate) order and is expected to die, that no resuscitation will be attempted. But physicians do not attempt to prove that the patient's cessation of circulatory and respiratory functions is irreversible at the moment they declare death. That the cessation of circulatory and respiratory functions is permanent comprises sufficient grounds for ordinary determination of death.

Thus, there is a disconnect between the apparent requirements of the criterion of death, articulated in death statutes like the UDDA, and the test of death that physicians actually conceptualize and employ. The criterion requires an irreversible cessation of functions, but the test requires only their permanent cessation.

Critics correctly observe that, in the large majority of hospital death determinations, a significant amount of time elapses between the time the loss of vital functions is detected and the time a physician is summoned to declare death and completes an examination. This elapsed time usually is sufficient to allow the permanent loss of vital functions to progress to becoming irreversibly lost. Some physicians I know even purposely dawdle when declaring death, to permit additional time to elapse to more confidently establish irreversibility. Thus, how often does the distinction between a permanent and irreversible loss of vital functions actually arise in clinical practice? Probably, it occurs infrequently. But despite its infrequency, the inescapable point remains that when physicians declare death, they generally do not care, or attempt to prove, that the loss of the patient's vital functions is irreversible; only that the loss is permanent. Thus, the implicit medical practice standard in death determination is permanence.

In an article analyzing the precise timing of death, Joanne Lynn and Ronald Cranford asserted four possible choices for stating the time of death, based on the loss of functions critical to life: "T1" when the critical function is lost; "T2" when the critical function is observed to be lost; "T3" when the critical function is irreversibly lost; and "T4" when the critical function is demonstrated to be irreversibly lost.²⁹ I have argued elsewhere that T4 is the most defensible time, because determination of death is made in retrospect.³⁰ Altering Lynn and Cranford's analysis (which was designed for the brain criterion of death) to apply to the cardiopulmonary criterion, T4 could be said to be the moment at which breathing and circulation are demonstrated to be permanently lost.

DETERMINING DEATH IN DCD

Now we can analyze determination of death in the DCD patient after five minutes of asystole. The reason that DCD advocates hold that the DCD patient is dead is not simply that the patient will not auto-resuscitate and will not be mechanically resuscitated. Instead, it is that the cessation of circulatory and respiratory functions is permanent, and that this permanence is identical to the permanence test implicit in physicians' usual determinations of death that are performed in other hospitalized patients using the cardiopulmonary criterion. Why should determination of death in DCD require a stricter standard of practice than determinations using the same criterion elsewhere in the hospital? And why do the critics of declaring death after five minutes of asystole in DCD patients not equally criticize physicians' use of a permanence standard in applying the cardiopulmonary criterion for determining death in patients elsewhere in the hospital, especially given that those determinations are performed much more commonly?

Physicians are secure in their reliance on a standard of permanence in their death tests, despite the statutory standard of irreversibility, for three reasons. First, the permanence standard has been accepted implicitly, if not explicitly, by the medical profession and society for the usual determination of death. No one is arguing that it is wrong, has produced incorrect results, and should be revised. Second, employing a test requiring only permanent cessation of respiratory and circulatory function always produces incipient, rapidly developing, and absolutely inevitable irreversibility of these functions. Therefore, using a standard of permanence rather than of irreversibility creates an inconsequential difference in outcome. And third, the weakest construal of *irreversibility* (permanence) was the one probably intended in death statutes when they were drafted, because that interpretation follows prevailing medical practices.³¹

But is changing to a permanence standard in DCD truly inconsequential in outcome? Jerry Menikoff, a critic of the report by the Institute of Medicine, who argues that DCD patients are not necessarily dead after five minutes of asystole, also points out the inconsequentiality of shifting from an irreversibility standard to a permanence standard. Menikoff explains that even though the DCD patient is not dead at the moment of organ retrieval, because the patient's brain is not yet fully destroyed, removing the patient's organs has *no effect* on the timing of the patient's subsequent death, because that timing is determined solely by the rate of

decay of brain cells, which, given the permanent cessation of breathing and circulation, is utterly unaffected by the removal of vital organs. Thus, even granting that the DCD patient remains alive (though incipiently dying) at the point of organ procurement, the organ procurement neither kills the DCD patient nor hastens death.³² For this reason, employing a permanence standard produces an inconsequential outcome for the DCD patient.

Critics may point out an additional important practical difference between determining death in a DCD patient and using the cardio-pulmonary criterion in other hospital death contexts. They may claim that while the distinction between permanent and irreversible may not matter in ordinary death declaration, as in the case of the dying cancer patient presented above, it does matter in the explicit death declaration in DCD. According to this argument, no harm is done to the ordinary dying patient by using a permanence standard, because death is expected and natural, and no intervention of any kind will be done to the patient as a result. By contrast, in using a permanence standard in the DCD patient, physicians may remove vital organs before respiratory and circulatory functions are irreversibly lost, an act that violates the dead donor rule and thus can produce harm.³³ I address this question next.

SHOULD WE ALTER PUBLIC POLICY ON DETERMINATION OF DEATH?

I have shown the presence of at least some degree of mismatch between the irreversibility standard required by the definition, criterion, and statute of death, and the permanence standard that physicians currently practice in their tests of death using a cardiopulmonary criterion.³⁴ Is there a compelling reason to correct this mismatch, either by changing the statute to permanence or the tests to irreversibility? I think not. As it is currently practiced in both ordinary hospital situations and DCD, this mismatch produces no adverse consequences because the outcomes are identical. It is not necessary to await rigor mortis or other unequivocal evidence of death before physicians declare death in the hospital and there are compelling social reasons not to do so.³⁵ Neither is it necessary to change the five-minute recommended guideline for asystole in determination of death in DCD, and there are compelling reasons involving organ viability not to do so. It is interesting that it is not that the advent of DCD has introduced a new standard of determination of death. Rather, DCD protocols simply have made explicit the presence of a long-standing practice of determination of death using the cardiopulmonary criterion that previously had not been clarified.

Permitting physicians to use a permanence standard instead of an irreversibility standard constitutes a compromise on biological reality, because, although the patient is incipiently dying at the point of permanence, the patient is not dead until the point of irreversibility. As a matter of public policy, is such a compromise justified? And is the compromise a violation of the dead donor rule? If so, is it a justified violation? And if it is a justified violation, is it one that the public will accept?

Enacting successful public policy on issues of life and death may require compromises on certain biological facts. Compromises may be acceptable if they satisfy three conditions: (1) they facilitate a socially desirable goal; (2) they are acceptable to the public and professional communities; and (3) they produce no differences in outcomes from the stricter practice or produce differences in outcome that are inconsequential. The use of a permanence standard for tests of death to demonstrate an irreversibility standard for the criterion and statute of death is an acceptable compromise because it satisfies the three conditions above. Therefore, we can defend permitting physicians to use a permanence standard in cardiopulmonary tests of death, as they do presently in cases of in-hospital death determination, including DCD.

Substituting a permanence standard for an irreversibility standard may violate the dead donor rule, the ethical axiom of procuring multiple vital organs which requires that the donor of multiple vital organs must first be dead.³⁶ If so, is this violation of the dead donor rule justified?³⁷ I have been a strong advocate of the dead donor rule, because I believe that it helps maintain public confidence in the organ transplantation enterprise, which remains precarious at best. We know from past experience that the public needs reassurance that physicians will not declare living patients dead to procure their organs.³⁸

For several reasons, I have concluded that if DCD does violate the dead donor rule, it comprises a justified exception. First, as I have shown, if the DCD patient is not dead at five minutes of asystole, the patient is incipiently and unequivocally dying, and will certainly be dead within minutes. Second, a state of irreversibility of cessation of breathing and circulation rapidly and inescapably follows the demonstration of permanent cessation of functions. Third, the outcome difference between a permanency and an irreversibility standard is inconsequential. Fourth, the patient or surrogate has provided consent to permit organ removal at this stage, saying that a condition of permanence comprises sufficient grounds for determining death from the patient's perspective.³⁹ Fifth, other patients benefit from donation of the organs, so it constitutes a socially desirable goal. Sixth, the U.S. Department of Health and Human Services and expert advisory bodies (for example, the Institute of Medicine) favor and encourage this type of transplantation activity. And, finally, the dead donor rule was developed to prevent organ donors from being killed for their organs. But violating it in this case does not lead to the death of the patient, so its *raison d'être* does not apply in DCD.

Will society tolerate knowing that patients are serving as vital organ donors before they are unequivocally dead, once this fact is better publicized? I conclude that our society will permit the practice for three reasons. First, the claim of some critics that "DCD is killing an almost dead patient for organs" is simply false. As Menikoff explains, the organ donation does not cause or even accelerate the patient's death. DCD patients are dead when their brains are destroyed by cessation of breathing and circulation, as evolving inevitably over minutes from being permanently lost to irreversibly lost. If critics wished to assign causation to the death of the patient, what "killed" the DCD patient was the earlier withdrawal of life-sustaining therapy, an act that is widely practiced and constitutionally protected, and, according to DCD protocols, would have been performed irrespective of organ donation. Second, most DCD patients will not care if they are declared dead earlier in a process that quickly and inevitably achieves irreversibility, because they wish to donate, and the difference to them is utterly inconsequential. And third, in my experience, most physicians seem to express no problem declaring DCD patients dead at five minutes of asystole, because doing so is consistent with their current practice of using a permanence standard for death declaration elsewhere in the hospital.

FUTURE DIRECTIONS

There are several areas in research and education that demand further attention before DCD determination of death can be fully and successfully implemented. First, we need additional studies to enhance the modest body of empirical data on the frequency of auto-resuscitation in ICU (intensive care unit) patients who develop asystole after cessation of ventilator therapy. It takes thousands of patients to comprise an adequate sample to assert the minimum duration of asystole necessary to confidently state that the cessation of circulation is permanent. Although there is no current evidence that the five-minute interval recommended by the Institute of Medicine is wrong, further study would enhance its validity and clarify the precise and optimal duration of asystole.

Second, we need greater standardization of physicians' practices in determining death in DCD patients. It is well known that DCD protocols for determining death vary somewhat among organ procurement organizations, particularly in the duration of asystole necessary to determine death. Just as there is disturbing evidence that some physicians continue to perform and document brain-death determinations inadequately,⁴⁰ standardizing optimum practices for physicians in determining death in DCD patients is clearly desirable. We should work toward developing an evidence-based, optimum practice standard for determining death in DCD.

Third, we need studies of physicians' practice behavior in the DCD context. In my discussions with colleagues during the implementation of a DCD protocol in my hospital, I discovered two common areas of concern surrounding the question of determination of death. Several ICU physicians opposed the DCD protocol because they feared that, if patients' families knew of its existence, this might influence conversa-

tions about withdrawing life-sustaining therapy. In particular, the physicians worried that knowledge of the protocol might subtly encourage family members to withdraw life-sustaining therapy that they otherwise might continue. Several nurses expressed their concern that if a DCD patient did not develop asystole quickly enough following removal from the ventilator, that physicians would purposely end the patient's life by administering high dosages of opioid drugs, because of the obvious pressure exerted by surgical staff, who would be scrubbed and anxiously awaiting the donor patient. Although there are no data to validate these concerns, these are legitimate areas for study, because DCD protocols are based on the premises that the decision to withdraw life support will be made independently of the decision to donate organs, and that optimal palliative care will be given to DCD donors following withdrawal of life-sustaining therapy, but that they will not be euthanized.

Fourth, education on determination of death in DCD obviously is needed for physicians and the public. Just as Stuart Youngner and colleagues have shown that in brain-death, that physicians, nurses, and the public inadequately understand the conceptual and practical issues involved,⁴¹ a similar ignorance undoubtedly exists regarding DCD. Surveys can accompany the educational process to assess the degree to which members of the public and of the professional community accept the concept of DCD, and, in particular, the practice of determining death at the point that respiratory and circulatory functions cease permanently, but before they cease irreversibly.

Finally, it would add clarity to the analyses of the concept and determination of death if scholars more consistently separated the meanings of *irreversible* and *permanent* when describing cessation of vital functions. I have shown that using the term *permanent* for Cole's weakest construal of *irreversible* conforms to ordinary understanding and usage, follows physicians' prevailing practices of determining death, and may have been the meaning of *irreversible* that was intended by the framers of the UDDA.

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NOTES

1. The total number of DCD donors in the U.S. more than tripled between 1999 and 2003. DCD now accounts for up to 24 percent of organ donation in the organ procurement organization of the most active DCD program. See F.L. Delmonico et al., "Organ Donation and Utilization in the United States, 2004," *American Journal of Transplantation* 5, part 2 (2005): 862-73.

2. University of Pittsburgh Medical Center Policy and Procedure Manual, "Management of Terminally Ill Patients who May Become Organ Donors after Death," *Kennedy Institute of Ethics Journal* 3 (1993): A1-15.

3. The most current DCD data were reported in J.L. Bernat et al. "Report of a National Conference on Donation after Cardiac Death," *American Journal of Transplantation* 6, (2006): 281-91.

4. Institute of Medicine, *Non-Heart-Beating Organ Transplantation: Medical and Ethical Issues in Procurement* (Washington, D.C.: National Academy Press, 1997) and Institute of Medicine, *Non-Heart-Beating Organ Transplantation: Practice and Protocols* (Washington, D.C.: National Academy Press, 2000).

5. Former Secretary of the DHHS, Tommy Thompson, appointed the Advisory Council on Transplantation that recommended active pursuit of DCD in all hospitals. See Council Recommendation #14 in <http://www.organdonor.gov/acotreccsbrief.html>. Thompson also supports the Health Resources and Services Administration (HRSA) Organ Donation Breakthrough Collaborative, whose goal is to increase the rate of organ donation in the U.S., one of whose six key strategies is DCD.

6. Organ procurement organization DCD protocols vary on the stipulated length of time of asystole required to declare death. Most have adopted the recommendation by the IOM of five minutes, but some use two minutes. In the Netherlands, they wait 10 minutes.

7. I use the term *asystole* hereinafter not in its strictest sense, meaning an absence of recordable electrocardiographic activity, but in its more general sense, meaning an absence of cardiac activity sufficient to generate a

pulse or blood flow. When the heart stops after apnea, the cardiac rhythm usually diminishes gradually before stopping, but the resultant weak cardiac electrical signal is insufficient to produce a cardiac contraction necessary to create a pulse or blood flow. This condition of absent pumping, despite a present cardiac rhythm, known as "electromechanical dissociation," precedes the total absence of cardiac electrical activity. But it is simpler merely to say *asystole* because heartbeat and circulation stops even if an ineffectual cardiac signal persists temporarily. This phenomenon has been studied in a series of patients. See E.F.M. Wijdicks and M.N. Diringer, "Electrocardiographic Activity after Terminal Cardiac Arrest in Neurocatastrophes," *Neurology* 62 (2004): 673-74.

8. J. Lynn, "Are the Patients Who Become Organ Donors under the Pittsburgh Protocol for 'Non-Heart-Beating Donors' Really Dead?" *Kennedy Institute of Ethics Journal* 3 (1993): 167-78; R.D. Truog, "Is it Time to Abandon Brain Death?" *Hastings Center Report* 27, no. 1 (1997): 29-37; and S.J. Youngner, R.M. Arnold, and M.A. DeVita, "When is 'Dead'?" *Hastings Center Report* 29, no. 6 (1999): 14-21.

9. J. Menikoff, "Doubts About Death: The Silence of the Institute of Medicine," *Journal of Law, Medicine & Ethics* 26 (1998): 157-65; and J. Menikoff, "The Importance of Being Dead: Non-Heart-Beating Organ Donation," *Issues in Law and Medicine* 18, no. 1 (2002): 3-20.

10. Approximately 25 percent of patients in DCD protocols, following ventilator removal, continue to breathe and have heartbeat for greater than one hour before they die, rendering them unsuitable for DCD for logistical reasons. See note 1 above.

11. See notes 8 and 9 above.

12. The absence of auto-resuscitation comprises a critical point of the argument and is one that is answerable using empirical data. There are relatively few studies, but all report no instances of auto-resuscitation after five minutes of asystole. These data are summarized in M.A. DeVita, "The Death Watch: Certifying Death Using Cardiac Criteria," *Progress in Transplantation* 11 (2001): 58-66; M.A. DeVita et al., "Observations of Withdrawal of Life-Sustaining Treatment from Patients who Became Non-Heart-Beating Organ Donors," *Critical Care Medicine* 28 (2000): 1709-12; and Institute of Medicine, *Non-Heart-Beating Organ Transplantation: Practice and Protocols*, see note 4 above.

13. President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, *Defining Death: Medical, Legal and Ethical Issues in the Determination of Death* (Washington, D.C.: U.S. Government Printing Office, 1981), 72-84.

14. *Ibid.*, 31-43.

15. J.L. Bernat, C.M. Culver, and B. Gert, "Defining Death in Theory and Practice," *Hastings Center Report* 12, no. 1 (1982): 5-9.

16. Elsewhere I have defended the assertion that death is intrinsically irreversible. See J.L. Bernat, "The Biophilosophical Basis of Whole-Brain Death," *Social Philosophy & Policy* 19, no. 2. (2002): 324-42 and J.L. Bernat, "A Defense of the Whole-Brain Concept of Death," *Hastings Center Report* 28, no. 2 (1998): 14-23. For an opposing opinion, see D.J. Cole, "The Reversibility of Death," *Journal of Medical Ethics* 18 (1992): 26-30.

17. E.T. Bartlett, "Differences Between Death and Dying," *Journal of Medical Ethics* 21 (1995): 270-76.

18. My colleagues and I also used the words *permanent* and *irreversible* interchangeably in the past in this context. See, J.L. Bernat, C.M. Culver, and B. Gert, "On the Definition and Criterion of Death," *Annals of Internal Medicine* 94 (1981): 389-94.

19. *The Oxford English Dictionary*, 2d ed. (Oxford: Oxford University Press, 2006).

20. *Ibid.*

21. I am grateful to Don Marquis and Jeff McMahan for first explaining this distinction to me. See J. McMahan, "The Metaphysics of Brain Death," *Bioethics* 9, no. 2 (1995): 91-126. But we all acknowledge that in some social and clinical contexts our usages of *permanent* do not necessarily rely on intent or action, and mean irreversible.

22. Others have attempted to make a similar distinction by offering multiple interpretations of *irreversibility*. See J.A. Robertson, "The Dead Donor Rule," *Hastings Center Report* 29, no. 6 (1999): 6-14, and Youngner, Arnold, and DeVita, "When is 'Dead'?" see note 8 above.

23. D. Cole, "Statutory Definitions of Death and the Management of Terminally Ill Patients who May Become Organ Donors after Death," *Kennedy Institute of Ethics Journal* 3, no. 2 (1993): 145-55 and see Cole, "The Reversibility of Death," see note 16 above.

24. D. Lamb, "Reversibility and Death: A Reply to David J. Cole," *Journal of Medical Ethics* 18 (1992): 31-3.
25. J. Lizza, "Potentiality, Irreversibility, and Death," *Journal of Medicine and Philosophy* 30 (2005): 45-64.
26. D. Cole, *Kennedy Institute of Ethics Journal* (1993): 149. Cole separates but criticizes all three construals of *irreversible*.
27. Youngner, Arnold, and DeVita, "When is 'Dead'?" see note 8 above.
28. L. Carroll, *Through the Looking Glass: And What Alice Found There* (New York: Books of Wonder, 1993).
29. J. Lynn and R.E. Cranford, "The Persisting Perplexities in the Determination of Death," in *The Definition of Death: Contemporary Controversies*, ed. S.J. Youngner, R.M. Arnold, and R. Shapiro (Baltimore: Johns Hopkins University Press, 1999), 101-14.
30. J.L. Bernat, "The Biophilosophical Basis of Whole-Brain Death," *Social Philosophy & Policy* 19, no. 2 (2002): 324-42.
31. According to Alexander M. Capron, Executive Director of the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, in the seminal work *Defining Death: Medical, Legal and Ethical Issues in the Determination of Death* (see note 13 above), the President's Commission used the words *permanent* and *irreversible* interchangeably (see example on pp. 83-4), although they chose *irreversible* for the UDDA. Alexander M. Capron, communication with the author, 7 April 2005.
32. J. Menikoff, "Doubts About Death: The Silence of the Institute of Medicine," *Journal of Law, Medicine & Ethics* 26 (1998): 157-65.
33. Jerry Menikoff, communication with the author, 4 February 2005.
34. There is no mismatch if only the weakest construal of *irreversibility* is understood as the implied meaning in death statutes. But most scholars presume a stronger construal. In the discussion that follows, I will assume the intermediate (Cole's weak but not weakest) construal.
35. For a history of physicians' determination of death in previous centuries that describes the variety of tests employed to assure that the patient was truly dead, including prolonged observation to the point of rigor mortis, see D.J. Powner et al., "Medical Diagnosis of Death in Adults: Historical Contributions to Current Controversies," *Lancet* 348 (1996): 1219-23.
36. J.A. Robertson, "The Dead Donor Rule," see note 22 above.
37. See the discussion of this question in R.M. Arnold and S.J. Youngner, "The Dead Donor Rule: Should We Stretch it, Bend it, or Abandon it?" *Kennedy Institute of Ethics Journal* 3, no. 2 (1993): 263-78.
38. Elsewhere I have discussed the publicized cases showing the fragility of public confidence in the organ transplantation enterprise, particularly in physicians' determination of death in the organ donor. See, J.L. Bernat, *Ethical Issues in Neurology*, 2nd ed. (Boston: Butterworth-Heinemann, 2002), 262-65.
39. Tom Tomlinson criticized Cole's analysis of *irreversible* on ethical, not conceptual grounds. He claimed that "the possibility of reversal is not ethically significant" if the DCD patient has consented to organ donation, because declaring the patient dead at this point respects her or his wishes for organ donation. See T. Tomlinson, "The Irreversibility of Death: Reply to Cole," *Kennedy Institute of Ethics Journal* 3, no. 2 (1993): 157-65.
40. See, for example, R.E. Mejia and M.M. Pollack, "Variability in Brain Death Determination Practices in Children," *Journal of the American Medical Association* 274 (1995): 550-53, and M.Y. Wang, P. Wallace, and J.B. Gruen, "Brain Death Documentation: Analysis and Issues," *Neurosurgery* 51 (2002): 731-35.
41. S.J. Youngner et al., "'Brain Death' and Organ Retrieval: A Cross-Sectional Survey of Knowledge and Concepts Among Health Professionals," *Journal of the American Medical Association* 261 (1989): 2205-10.