

Is Death Irreversible?¹

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Abstract

There are currently two legally established criteria for death: the irreversible cessation of circulation and respiration and the irreversible cessation of neurologic function. Recently there have been technological developments that could undermine the irreversibility requirement. In this paper, I focus both on whether death should be identified as an irreversible state and on the proper scope of irreversibility in the biological definition of death. In section two of this paper, I tackle the distinction between the commonsense definition of death and the biological definition of death to show that even the commonsense concept of death is specified by biological facts. Resting on this argument, in section three of the paper, I argue that any definition of death is *a posteriori*. Thus, irreversibility is part of any definition of death because the actual phenomenon of death is irreversible. In addition, I show that the proper domain of irreversibility in a definition of death is circumscribed by physical possibilities and that irreversibility in the definition of death refers to current possibilities for the reversal of relevant biological processes. I conclude that despite recent technological advancements, death is still irreversible.

Keywords: brain death, BrainEx, irreversibility, death, cardiopulmonary death

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1. Introduction

There are currently two legally established criteria for death: the irreversible cessation of circulation and respiration and the irreversible cessation of neurologic function, i.e., cardiopulmonary death and brain death respectively. While cardiopulmonary death has been accepted as the marker of biological death, there are both legal (Klugman, 2015) and philosophical challenges to the identification of brain death with biological death (Cole, 1992; Collins, 2010; Nair-Collins, 2013; Shewmon, 1998, 2004, 2010; Robert D Truog, 2007; Robert D. Truog & Miller, 2014; Veatch, 2005). Most recently, however, there have been also technological advancements that might undermine the irreversibility requirement contained in both criteria. For example, the invention of extracorporeal membrane oxygenation (ECMO) that can supplant normal heart and lung function and maintain circulation of blood and oxygen in the body. An even more recent scientific development is *BrainEx* (*BEx*) (Vrselja et al. 2019), a system that was successful in restoring and maintaining circulation and cellular viability in *ex vivo* pig brains hours after death. According to Vrselja et al. (2019), the study demonstrated restoration of some activity at the cellular level, but *BEx* did not restore function that could lead to perception, consciousness, or any other brain function.²

²The distinction between cellular activity and brain function is important because proponents of brain death as biological death argue that cessation of all neurological function is not required for brain death (President's Commission 1981). Based on this distinction, restoration of cellular activity is not the same as restoration of brain function. One could argue against the distinction between brain function and cellular activity by maintain that all brain function ultimately reduces to cellular activity of the type restored by *BEx*. (I would like to thank an anonymous reviewer for this suggestion.) Although a discussion of the relationship between cellular and brain function is beyond the scope of this paper, it is important to note that the *BEx*, *de facto*, did not restore brain function, especially not functions associated with perception or consciousness. Ultimately, the main thrust of my paper, that death is an *a posteriori* concept, does not depend either on the distinction between cellular and brain function nor on the particular success of *BEx* in restoring either type of function.

These recent technological advances highlight the need to specify the meaning of irreversibility in both the concept of death and the criteria for death. In this paper, I focus both on whether death should be characterized as an irreversible state and on the proper scope of irreversibility in the biological definition of death. There is a debate about whether death as a biological concept needs to account for commonsense or ordinary notions of death; this debate includes a dispute about whether irreversibility is part of the concept of death. In section two of this paper, I tackle the distinction between the commonsense definition of death and the biological definition of death in order to argue that any notion of death requires irreversibility. I argue that the biological notion of death does not need to satisfy the commonsense notion of death for two reasons: first, there is not one universal commonsense notion of death and, second, some commonsense notions of death are specified by biological facts. In section three, utilizing the claim that even commonsense notions of death incorporate biological facts, I argue that any definition of death is *a posteriori*. Thus, irreversibility is part of any definition of death because the actual phenomenon of death is irreversible. In addition, I show that the proper domain of irreversibility of death is circumscribed by physical possibilities, not logical or metaphysical possibilities, and that irreversibility in the definition of death refers to current possibilities for the reversal of relevant biological processes. I conclude that despite recent technological advancements, death is still irreversible.

2. Commonsense Biological Death

One of the issues raised in the debates about death in general, and brain death in particular, is the relationship between the biological definition of death and the ordinary or commonsense notion

of death used in everyday life.³ In fact, one of the challenges to the brain-death criterion for death is the contention that it does not accord with the commonsense notion of death. Defenders of brain death reject that view and maintain both that the biological definition of death should account for the commonsense death and that brain death does accord with commonsense about death. Bernat (2002), for example, argues that in order to define death, one should settle on a view about what is commonly meant by death before physicians measured it (p. 327), i.e., that the definition of death should capture the pre-scientific notion of death. Moreover, Bernat (2002) maintains that death is a nontechnical word and that a biological definition of death must maintain this feature. Gert, Culver, and Clouser (2006) also argue that death is primarily an ordinary term and not one that is medically and legally defined. The 1981 The President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research similarly emphasized the importance of not changing the traditional definition of death (The President's Commission, 1981).

The features of commonsense death have been debated and a consensus has not emerged on the right way to characterize it. Some of the debated features of death include: whether death is irreversible; whether death is a process or an event; and, whether death is a biological, or more broadly a physical, state. Bernat (1998) has argued that any conception of death, including the commonsense notion, requires irreversibility. On the other hand, Cole (1992) has argued that the ordinary notion of death does not require irreversibility. Cole argues that death is not irreversible because based on everyday parlance it is not a contradiction to describe death as a reversible event. For example, as Cole points out, in everyday parlance it is not a contradiction to speak of

³ Throughout the paper, I will use 'ordinary death' and 'commonsense death' interchangeably to designate the notion of death utilized in everyday parlance by laypersons.

a dead individual as being revived through resurrection. According to Cole, the scientific notion of death, specifically brain death, is a stipulated conception of death that is devised to serve clinical or scientific purposes. This stipulated conception is not entirely compatible with ordinary death because of the requirement of irreversibility contained in the biological definition.

Another debate is about whether death is an event. A number of authors have characterized death as a physical event that happens at a particular moment (Bernat, 1998; Huang & Bernat, 2019; Shewmon, 2010). As with irreversibility, however, there are controversies about whether death can be properly characterized as a single physical event. For example, some have argued that death is a physical process and not an event (Chiong, 2005; Cole, 1992). If death is a process, then any particular moment chosen to designate death is to a certain extent arbitrary. Think, for example, of designating a particular age as the time when a person reaches the stage of maturity that allows them to drive, drink, or enroll in the army. If cognitive maturation is a process, then designating any particular moment as the time when a person becomes mature seems to an extent arbitrary. Similarly, a physician who chooses the loss of a heartbeat as the moment of death is selecting that particular moment somewhat arbitrarily as several moments right before or after the loss of heartbeat could have been chosen to designate the loss of unified organism functioning.

Finally, there is a debate about whether death is a biological concept. Veatch, for example, has argued that death is primarily a moral notion. Thus, when an individual dies, we are no longer required to treat that individual as a person. For example, we no longer need to provide medical care to dead persons and we are permitted to bury them. Shewmon (2010), however, argues that death is a physical event and that it is the occurrence of this event that justifies cessation of medical care and the withdrawal of moral regard reserved for live individuals.

For the most part, when identifying these commonsense features of death, commentators rely on something like an analysis of ordinary terms. Huang and Bernat (2019) and Cole (1992) both seem to indicate that their primary method for identifying the features of death relies either on commonly held intuitions or on the way in which the term ‘death’ is invoked in everyday parlance. In order to show that reliance on analyzing the ordinary concept of death will neither yield a single, universal concept of death nor help in circumscribing a purely commonsense concept, I will utilize a particular type of methodology for defining the meaning of commonsense terms. This method was proposed by Lewis (1972) who used it both as a way of circumscribing the domain of folk psychology and of defining its terms. In addition, Lewis argues that folk psychology is a theory because it includes law-like generalizations that can be used to explain and predict human behavior. I will first describe Lewis’s proposal and then I will apply it to fix the meaning of commonsense death.

Folk psychology (FP) (sometimes also referred to as commonsense psychology) designates the quotidian ways in which laypersons, i.e., not individuals formally trained in psychology or psychiatry, explain and predict human behavior, by invoking mental states, such as beliefs, desires, sensations, etc.⁴ Based on Lewis’s approach, to identify the scope of FP, one would collect psychological platitudes, which he characterizes as commonly used and universally accepted psychological statements that feature psychological terms, such as ‘belief,’ ‘desire,’ and ‘sensation’ (Lewis, 1972). Based on Lewis’s view, this collection of commonsense platitudes implicitly defines psychological terms by specifying the functional roles of those mental states in

⁴ There are additional folk theories, such as folk physics and folk mathematics. These fields designate layperson beliefs within the relevant scientific domain. There has been some work identifying the tenets of folk physics, see Dennett (1991).

quodidian psychological explanations. For example, this method allows us to fix the definition of the term ‘desire’ by identify the role desire plays in our everyday psychological explanations.⁵

Based on Lewis’s approach folk psychology is a theory specified by shared psychological platitudes and it features two different kinds of terms: theoretical terms (T-terms) and observational terms (O-terms). T-terms are introduced by the theory specified by the collected platitudes. For folk psychology the T-terms are mental terms. The meaning of T-terms is not known prior to collecting the platitudes that comprise the theory. All other terms referenced in the platitudes are O-terms. The meaning of O-terms is known prior to the introduction of the theory about mental terms because their meaning has been fixed by other theories. The O-terms of one theory are the T-terms of another. The O-terms of the collected platitudes implicitly define the T-terms by specifying their function. Based on this view, the distinction between pre-theoretical terms and theoretical terms aligns with the distinction between the terms introduced by a theory, i.e., T-terms, and the terms defined by other theories, i.e., O-terms. Each term acquires meaning by having a particular causal role in a theory and no terms have meanings pretheoretically. Here I should underscore that the distinction between theoretical and observational terms is not categorical and that each term can be observational or theoretical depending on the role it serves in a particular theory. As I will illustrate in the next few

⁵ It is important to note that although the term ‘platitude’ in the context of drawing boundaries of commonsense concepts has been utilized mostly by philosophers, the methodology suggested by Lewis is not uncommon and is similar to those employed in the social sciences, such as anthropology or social psychology, when the goal is to identify the views of a certain group of individuals on a particular topic. In addition, much of experimental philosophy has employed similar approaches to identify commonsense views on a range of traditionally philosophical topics, including views on personal identity (for just one example, see Strohminger and Nichols 2014). As I suggest later in the paper, utilization of Lewis’s approach would reveal that there is not one universally endorsed conception of death, but I do contend that it could be used to identify current regional, cultural, and situational views about death.

paragraphs, terms such as ‘stethoscope’ or ‘heartbeat’ are observational terms in one theory, but theoretical in another. Furthermore, meanings of observational terms, on Lewis’s view, are not reducible to data obtained solely through the senses.

For example, consider the following story: Dr. Bouchut arrives to the bedside to determine whether a patient has died. Dr. Bouchut thinks the patient is dead. To confirm his suspicion, Bouchut attempts to determine the patient’s pulse. When he places his index finger at the base of the patient’s wrist, he cannot feel the patient’s pulse. Dr. Bouchut doubts the accuracy of his measure and reaches for the stethoscope because he knows that a stethoscope can be used to reliably determine whether the patient has a heartbeat. In this story, the T-terms would be those referring to Dr. Bouchut’s mental states such as ‘feels,’ ‘suspects,’ ‘believes,’ ‘doubts,’ and ‘knows.’ The observational terms are most of the others, including ‘stethoscope,’ ‘pulse,’ ‘heartbeat,’ ‘patient,’ etc. The meanings of the O-terms have been defined by other theories; for instance, the meaning of the term ‘heartbeat’ is defined by a biological theory that specifies the role of the heart in the functioning of the human organism. The definition of the term ‘stethoscope’ and the usefulness of the device in determining the presence and pace of a heartbeat have been set by other theories. The meanings of the T-terms, i.e., Dr. Bouchut’s mental states, are set by the role they play in mediating between external stimuli in Dr. Bouchut’s environment, such as, the patient’s countenance, the lack of heartbeat, etc., and his behavior, such as manually measuring heartbeat or using the stethoscope. For example, that Dr. Bouchut believes that the patient is dead explains why he attempts various ways of determining heart function. Furthermore, the belief that feeling the patient’s pulse is not a reliable measure of heart function, leads him to reach for the stethoscope.

This same approach could be utilized to determine the meaning of death. One could argue that the commonsense concept of death is part of a broader theory--commonsense or folk biology. Folk biology could be composed of platitudes about human organism functioning used by laypersons to explain and predict human functioning. To define death, one would collect all the platitudes that contain the term death. These would include utterances we use in situations in which we classify an individual as dead; specify the features of death; talk about what happens to an individual when they are dead; talk about who can diagnose somebody as dead; discuss what happens after death; and so forth. By collecting platitudes about death in this manner, one could determine the scope and the meaning of commonsense death. One could argue that the T-terms introduced are 'death,' 'irreversible,' 'event,' and 'physical.' Reading the story about Dr. Bouchut from the perspective of folk biology, not from the perspective of folk psychology, different terms would be designated as theoretical. For example, on the folk-biological reading, the T-terms would include 'death,' 'pulse,' and 'heartbeat.' The O-terms would be the terms not introduced by folk biology, which would include those referring to Dr. Bouchut's behavior and his mental states. This demonstrates that terms can switch from being theoretical to observational depending on theory. In addition, it demonstrates that the meaning of each term in everyday parlance relies on a web of conceptual frameworks. Finally, one should keep in mind that T-terms are functionally defined by the O-terms and that they are, as Lewis says, in principle eliminable. In other words, those terms do not necessitate any particular definition on their own; rather they acquire their meaning based on the O-terms.⁶

⁶ Here I would like to address a potential criticism of Lewis's argument that the meaning of T-terms is implicitly defined by their functional role in the theory which introduces them. Based on this view, it would seem that if a theory is false its theoretical terms would be rendered meaningless. (I would like to thank an anonymous reviewer for identifying this criticism.) This would be problematic as plenty of terms introduced by false theories seem to be meaningful,

It is important to note that although applying Lewis's functionalism here is demonstrated on ordinary terms, the same method can be applied to scientific terms. This means that the T-terms of any theory can be implicitly defined by causal roles specified by the O-terms. The meaning of death as a T-term in a biological theory about human functioning would be defined by the causal role specified by the O-terms of that theory. When using Lewis's functionalism we could eliminate a number of distinctions between commonsense death and biological death. First, Lewis's method demonstrates how ordinary terms can be characterized as theoretical terms of a theory that seeks to explain and predict certain phenomena. Second, Lewis's functionalism demonstrates that all terms are theoretical in the sense that the meaning of any term, including commonsense terms, is determined based on the role specified by the O-terms. Third, both scientific and commonsense T-terms are defined by their causal role specified by their theory. Thus, even when there are differences between commonsense death and biological death, the meanings of both terms are defined by their respective theories.

Returning now to the argument about the scope and definition of ordinary death. Using Lewis's method, the characterization of ordinary death would depend heavily on the type of locale where the platitudes were collected. There are likely significant cultural, religious, and regional differences in the utilization of the term 'death.'⁷ This in turn will lead to distinct notions of death across or even within different populations, which would prevent the

such as the term 'witch' or 'phlogiston.' Both those terms can be used in everyday parlance and people might know what they mean even if there are no witches or phlogiston. Lewis (1972) directly addresses this criticism and argues that the theoretical terms of a false theory are not meaningless; instead, they are like improper descriptions, i.e., not true of anything in the actual world. They remain meaningful because they could be true of something in a possible world. In other words, we could imagine world in which witches exist and therefore the term remains meaningful albeit not true of anything in the actual world.

⁷ This is true of other commonsense concepts as well, see Stich (1998).

establishment of a universally accepted commonsense concept of death. This result is particularly important if the friction between commonsense death and biological death requires a unitary commonsense conception of death. Without a universally accepted commonsense notion of death, it would be hard to maintain the requirement that commonsense death should be the basis of the biological definition of death. At best, one could argue that the biological notion of death should capture some, locally endorsed, commonsense concept of death.

A possible retort could be that if we were to adhere strictly to Lewis's method, we could collect only shared platitudes, only those claims about death that everybody knows and everybody would assent to, thereby reducing any regional, cultural, and other situational differences. This is perhaps why Huang and Bernat (2019) distinguish between the concept and conceptions of death. Their argument is that although there is a universal concept of death, conceptions of death require further specification and might differ depending on context. To ground the universal characteristics of death, they use a mixture of what they call desiderata and intuitions, and they contend that death is an irreversible biological event. Using Lewis's method, the precise content of such a universal notion of death would require empirical investigation, i.e., it would require the actual collecting of platitudes about death and then identifying consistencies across, what are bound to be, diverse conceptions of death. However, removing the specifications contained within any particular notion of death would result in a very general characterization of death, like the one specified by Huang and Bernat (2019). This would not be a positive outcome because the resulting concept of death would be ambiguous in a variety of ways and would not be helpful in resolving many of the debates about the definition of death.

Consider the definition proposed by Huang and Bernat (2019)--death is an irreversible physical event--any of the three explanantia of death are ambiguous in a variety of different

ways. As Cole pointed out irreversibility is ambiguous between current and future irreversibility. Similarly, the actual meaning of event could be ambiguous between singular event or particular moment in a process. The term physical could also be ambiguous between different types of physical events, i.e., the end of cardiopulmonary function or the loss of neurologic function. Even more broadly, the term physical can be ambiguous between something designating solely material objects, such as tables and chairs, or designating any event or process entailed by physical sciences.⁸ Using Lewis's terminology, without the required specifications provided by the O-terms, the T-terms on their own do not have a definite meaning. Thus, it is not possible to formulate a meaningful concept of death without relying on particular specifications. My argument here departs from the paradigm established by Bernat (2002) where the definition of death is distinguished from the criteria for death, i.e., the definition of death can be fixed without relying on how death is determined at the bedside. Based on my argument, specifications about how death is determined are required in order to establish the meaning of the term death. The biological definition of death is rendered meaningful through the specification of particular functions of the organism as crucial for the maintenance of the organism as a whole. Once particular specifications are included, however, instead of one universal conception of death, there could be distinct concepts of death that may be incompatible. For example, such an incompatibility could arise between the commonsense and the biological definitions of death. This would in turn make it impossible to argue that the biological definition could somehow satisfy or account for the commonsense definition of death.

In what follows, I will demonstrate that such an incompatibility between two concepts of death, although in principle possible, is unlikely. Moreover, I will demonstrate how the

⁸ For more on physicalism, see Stoljar (2001).

biological definition shapes the commonsense concepts of death. If one were to collect current and shared platitudes about death, the O-terms within that collection will derive from a variety of different sources. Those sources could include religious characterizations of death, but they will likely include scientific descriptions of it as well. Given that most individuals are declared dead by physicians, platitudes about death are based on the way physicians apply biological theories to determine death and on the way in which healthcare professional explain death to the family and friends of the deceased. Similarly, given that most countries base their legal criteria for death on the biological definition of death, and most physicians follow those legal criteria, the knowledge and direct experience with death and its diagnosis for many people is based on the implementation of the biological conception of death. Thus, commonsense death will include as O-terms the T-terms of biological theories. This means that the ordinary notion of death is specified by biological theories and facts.

I mentioned previously that there might be a variety of distinct ordinary notions of death. However, those differences are minimized in situations where laypersons interact with medical professionals. In clinical or research settings, most individuals converge on the biological conception of death. Even if an individual might have beliefs about death that are not compatible with the biological conception of organism functioning, say beliefs about an afterlife, he or she will still make decisions about the end-of-life based on biological conceptions about the functioning of an organism. For example, cardiopulmonary death is widely accepted by both physicians and laypersons and most individuals who are told that their loved one is dead will accept this diagnosis regardless of their religious beliefs. Thus, even if there are a variety of distinct ordinary notions of death, in the medical setting, everybody utilizes the biological conception of death. The lack of acceptance of the biological definition of death arises in relation

to the brain death criterion for death. But even those individuals who object to brain death still accept cardiopulmonary death as biological death.

This brings me to a particular way in which ordinary death has been characterized. In the literature on brain death, traditional death is identified with the cardiopulmonary criterion for death and even more specifically with the absence of a heartbeat (President's Commission 1981, pp. 12–15). Here, I wish to dispute the claim that the cardiopulmonary criterion is traditional death if by that one means that it is a pre-biological notion of death. The cardiopulmonary criterion for death was preceded by putrefaction as a criterion for death. During the seventeenth century, physicians were unable to distinguish between real and apparent death, which resulted in a significant number of false positives. To minimize errors when diagnosing death, putrefaction was established as the only criterion for death. This criterion was maintained through to the nineteenth century (Carpenter and Gurney 1862). The invention of the stethoscope enabled physicians to determine that a person was dead with more precision because it improved the ability to detect a heartbeat (President's Commission 1981, pp. 12–15). Thus, the invention of the stethoscope established the cardiac criterion for death and precipitated the displacement of putrefaction as the primary criterion for death.⁹ The establishment of cardiopulmonary death then contributed to the conception of death as the loss of cardiopulmonary function. Not only does the concept of traditional death, identified as cardiopulmonary death, rely on the endorsement of a

⁹ Bondeson (2002) identifies French physician Eugène Bouchut as being responsible for challenging putrefaction as the primary criterion for death. Bondeson writes: “Eugène Bouchut is remembered in the history of medicine for...his *Traité des signes de la mort et des moyens de prévenir les enterrements prématurés* [Treatise on the signs of death and the means of preventing premature burials] written in 1846. ...it is typically credited with fatally wounding the widespread belief that putrefaction is the only infallible sign of death, and setting out how death can be determined by other signs, notably by auscultation of the heart with a stethoscope” (Bondeson, 2001, 143-150). I would like to thank Robert Baker for alerting me to this reference.

biological theory of death that identifies the loss of heart function as the moment of death of the organism, but it also requires the tacit endorsement of the auxiliary scientific theories that supported the development of the stethoscope and justified its use to determine the presence and rate of a heartbeat. Thus, what is now considered traditional death depended on the introduction of technology that allowed for a more precise measurement of the relevant biological function of the organism.

Based on my arguments in this section, I conclude that there are communal and cultural differences among conceptions of death, i.e., different cultures and different communities might use more or less distinct concepts of death. If there are several distinct ordinary notions of death, then one cannot make it a requirement that the biological conception of death should capture the ordinary notion of death. I argued further that no conception of death is pre-theoretical because all conceptions of death acquire their meaning through their functional role in a particular theory. This means that the claim the biological death should be rooted in the commonsense death is equivalent to the requirement that a biological theory of death adopt the T-terms of the commonsense theory of death. If we take Lewis's view on how T-terms acquire their meanings, even adopting particular T-terms, such as irreversibility, into a theory of death would not guaranty that the meaning of those terms would remain the same in different theories because the meaning of all theoretical terms are implicitly defined by the observational terms. If the observational terms of a biological theory and those of a commonsense theory are different, then the theoretical terms of that theory will have different meanings. Thus, it would be impossible for a biological theory to account for a commonsense theory, if they have sufficiently distinct observational terms.

My argument thus far has been that particular versions of commonsense death and biological death have similar observational terms. I supported this claim in two ways: The first is a speculative argument about the character of the current ordinary notion of death, which is that the ordinary notion of death already contains observational terms from biological theories about human functioning. In effect, my argument is that instead of their being a contrast between the ordinary notion and the biological notion, there is a convergence on the same notion because the way in which laypersons speak about death in everyday life is influenced by the biological characterizations of death. Here I admit that the contrast between ordinary death and biological death might be greater in countries or cultures where science has had a less pervasive influence on everyday parlance. However, the meaning of biological death and ordinary death are most similar in situations where laypersons and clinicians are making shared medical decisions. In those situations, laypersons make medical decisions by more or less adopting the biological rendition of organism functioning. These are also the situations in which the scope of irreversibility is most important. My second and less speculative argument that ordinary death is affected, if not dependent, on the biological death is the example of the identification of cardiopulmonary death with the ordinary or traditional death. The entrenchment of the cardiac notion of death is evidence that scientific conceptions of death become incorporated into ordinary discourse, i.e., become part of everyday parlance, and thus contribute to the meaning of ordinary death. Thus, it would be best to dispense with the argument that there are two distinct concepts of death, one biological and the other common sense, instead what I have shown is that in clinical and research settings everybody settles on one biologically specified meaning of death.

3. Death and Irreversibility

To gauge the impact of technological advances, such as *BEx*, on the irreversibility as a crucial part of the concept of death, it is important to determine whether death requires irreversibility and whether irreversibility refers only to current scientifically established possibilities for reversal or if it covers a wider scope of possibilities as well.

As was mentioned previously, Cole (1992) has argued that the commonsense notion of death does not include irreversibility. He concludes this based on the everyday usage of the term death where it is not a contradiction to speak of death as reversible. For example, if some individuals believe that it is possible for the dead to be resurrected than it is conceivable for death to be reversible. Huang and Bernat (2019), however, identify the concept of death with an irreversible biological event. Cole aims to undermine the biological definition of death as the basis for the concept of death by stating that death is stipulated for particular medical or research purposes. He argues further that the meaning of irreversibility in the biological definition of death is ambiguous because it is not clear whether it designates current possibilities or future possibilities for reversibility. For example, an individual who is brain dead is only irreversibly dead based on current abilities to restore function to the brain or any other organ. But one could easily conceive of a time and perhaps even of a way in which our abilities to reverse death will improve and when people who are currently brain dead might not be irreversibly dead. Cole argues that we cannot be sure what our obligations to the currently dead are because of the ambiguity of irreversibility. It is not clear whether we should withdraw all medical care from these individual or perhaps whether we should cryopreserve them in waiting for a future when they might become resurrected through some new technology. Because Cole is invoking conceivability as a way of determining the scope of death, I take him to be saying something

about our knowledge of possibilities. The claim is that even in situations where we know that something is the case, say that an individual is dead, we can also know that things could have turned out differently because we can conceive of scenarios in which the person would no longer be dead.

To assess whether reversible death is conceivable I will rely on the standard view in the epistemology of modality that distinguishes three different kinds of possibilities: logical possibilities, metaphysical possibilities, and physical possibilities (Vaidya, 2007). Logical possibilities encompass any possibility that does not create a logical contradiction, such as that something is both round and not round at the same time. There are no other restrictions on logical possibility, anything that does not generate a contradiction is possible regardless of how implausible. For example, round squares is often considered logically impossible because roundness and squareness are thought to negate each other so no object can be both round and square. A more restrictive type of possibility is metaphysical possibility, which are logical possibilities that are also compatible with the nature of any things that exist in the actual world plus any things that could have existed. There are controversies about the kinds of phenomena that are metaphysically impossible, but there is some consensus that the falsity of certain mathematical truths is metaphysically impossible. For example, it is metaphysically impossible for $2+2=5$. Finally, there are physical possibilities, which are metaphysical possibilities restricted by laws of nature.

In order to determine the type of possibility that should underlie discussions about the scope of irreversibility in the definition of death it needs to be determined whether the identification of death with an irreversible state is *a priori* analytic or *a posteriori* synthetic. The traditional distinction between analytic and synthetic truths refers to the ways in which certain

sentences are true. For example, analytic sentences, such as “Bachelors are unmarried man,” are true in virtue of the meanings of the terms utilized in the sentence. Synthetic sentences, such as “Water is H₂O,” are true in virtue of how the world is. The terms *a priori* and *a posteriori* are epistemological and refer to the way in which one gains knowledge of certain statements. *A priori* statements are those that can be known through reason alone. For example, the statement: “Bachelors are unmarried men,” can be known just by knowing the meaning of the relevant words. In order to determine that bachelors are unmarried men, we need not conduct a survey about how many bachelors are unmarried, we can simply reflect on the meaning of the word bachelor in order to know that it refers to unmarried men. Knowledge of *a posteriori* statements, such as “Water is H₂O,” is gained by becoming acquainted with some fact about the world. *A posteriori* statements, such as “Water is H₂O,” are justified through empirical means. In order to identify water with the molecule H₂O, one needs an empirical discovery that supports the claim that water is H₂O. The epistemological access, either *a priori* or *a posteriori*, is thought to coincide with the analytic synthetic distinction; this is way *a priori* sentences were usually thought to be analytic while *a posteriori* statements were considered synthetic. Subsequently there have been challenges both to the distinction between analytic and synthetic truths (Quine 1976), as well as to the notion that only *a priori* statements are analytic (Kripke 1972).

In what follows, I aim to show that the definition of death is *a posteriori*. I will adopt the following definition: Death is the irreversible cessation of the functioning of the organism as a whole. This definition of death has the same structure as the definition of water as H₂O. The definition of water identifies it with a molecular compound H₂O, while death is identified with the irreversible cessation of the functioning of the organism as a whole. My claim is that “Death is the irreversible cessation of the functioning of the organism as a whole” is an *a posteriori*

synthetic claim. The adequacy of this particular definition is not crucial for my view; the conclusion of my argument will apply to any definition or characterization of death. Thus, one need not endorse my characterization of death to accept my argument that any definition of death would be *a posteriori*.

Both Cole (1992) and Bernat (2002) imply that the definition of death can be settled *a priori*. Bernat (2002), for example, argues that the general definition of death can be settled on before the criteria for death are identified and before the clinical tools to identify death are characterized. In effect, he seems to be distinguishing the definition of death from the empirical means of identifying death. Cole might also be taking the view that death is an *a priori* concept because he thinks that we can gain epistemic access to possibilities about the reversibility of death using conceivability. Although a thorough discussion of the proper characterization of conceivability is beyond the scope of this paper, Chalmers (2002) has defined conceivability as a way of accessing either logical or metaphysical possibilities, i.e., possibilities that can be determined using reason alone. Based on that view, conceivability is not a reliable way of knowing physical or natural possibilities because knowledge of those possibilities depends on empirical discovery.

There are a variety of different strategies one could use to argue that any characterization of death is *a posteriori* concept and that conceivability does not provide epistemic access to possibilities about death. One way of doing it is by applying Quine's argument in *Two Dogma's of Empiricism* (van Orman Quine, 1976). Quine undermines the distinction between analytic and synthetic truths, and argues that the totality of our knowledge or beliefs is in principle revisable through empirical evaluation. It is important to note that Quine argues that no single statement can be on its own empirically evaluated; instead, his argument is that one can properly evaluate

statements only by evaluating the conceptual frameworks within which individual statements are embedded. If that is true, then knowledge or beliefs about death when they are part of a larger theoretical or conceptual framework, such as a folk or scientific biology, are empirically evaluable and in principle revisable. This application of Quine's argument can be used to reinforce the argument I made in section 2 of the paper, that the truth of the definition of death cannot be evaluate separately from the ways in which death is measured or identified at the bedside. Based on Quine's view there is not a domain of definitions that are true analytically and knowable through cogitation alone, and a domain of claims that are true synthetically and knowable empirically, instead all statements or beliefs are integrated into a conceptual framework that are all together evaluable and revisable through empirical investigation. Based on Quine's argument the definition of death as an irreversible state would be *a posteriori* synthetic.

If one is not persuaded by Quine's challenge of the analytic synthetic distinction, one could rely on Kripke's argument that even *a posteriori* identities such as "Water is H₂O" can be necessarily true. Most simply, Kripke's argument is that some terms, such as 'water,' are rigid designator, and refer to *actual* water in every possible world. Kripke's argument is that the meaning of the term 'water' is fixed by its identification with H₂O, and that fixed meaning constrains the term water in any possible world. According to Kripke, it would be inconceivable for water not to be identical to H₂O because the meaning of the term water is constrained by its meaning in the actual world. Thus, every time we imagine or conceive of a world with water we are conceiving of water as H₂O. One could utilize the same argument to claim that 'death' is a rigid designator. For example, if the meaning of the term death is fixed in the real world by a particular definition, say "Death is the irreversible cessation of the function of the organism as

whole” then the meaning of the term death would be restricted by that definition in any possible world where death occurs. Furthermore, it would be inconceivable for death to be a reversible state in any world where death occurs because anytime one refers to death one refers to it utilizing the meaning set for it in the actual world. Hence, it would be inconceivable for death to be a reversible state.

Now, it is important to note that the meaning of the term ‘death’ is not as uncontested as the meaning of the term ‘water.’ In other words, the identity between water and H₂O is much better established than is any definition of death that identifies it with a physical state. Thus, one could argue that although ‘water’ is rigid, ‘death’ is not because the meaning of death has not been yet fixed in the actual world. After all, as I described in section 2 of the paper, there are a variety of disputes about the meaning of the term ‘death.’

This is why I will make my final argument that the definition of death is *a posteriori*, and that the scope of irreversibility is set by physical possibilities, by reverting back to the argument I made in the previous section. This will also allow me to unify my argument that death is *a posteriori* with my argument derived from Lewis’s functionalism. In section 2, I argued that although it might be possible to identify distinct conceptions of death, I argued that even the commonsense concept of death incorporates physical facts about human functioning. In particular, I argued that in medical and research settings most individuals, physicians and laypersons, accept a biological rendition of the concept of death. The disputes about brain death revolve around its bona fides as a biological definition of death, and even those individuals, laypersons, physicians, or bioethicists, who do not accept brain death as a biological death, do accept some physical state, e.g., the loss of cardiopulmonary function, as the marker of biological death. In other words, most any concept of death utilized in situations where one

determines whether an individual has died, invokes the identification of death with a physical state.

Utilizing Lewis's functionalism, we can argue that the meaning of death is defined by the observational terms of the current biological theory of human functioning. Similarly, when irreversibility is utilized in the context of biological functioning it is a T-term of the biological theory of human functioning and the meaning of irreversibility would be set by relevant observational terms within that theory's domain. For example, if we think of certain kinds of cell death as being the irreversible end of cell function, then death of the entire or most of the brain, which would entail the death of most of the cells in the brain would indicate the irreversible loss of brain function. Based on this view, it is not possible for a brain-dead individual to be revived because certain kinds of lost function in cells cannot be restored. Hence, if possibility for reversal is grounded in biological theory or knowledge of physical theories, then it would not be possible that an irreversible process could be reversed. Vrselja et al.'s article (2019) demonstrated that *BEx* can be used to restore certain kinds of functioning in cells previously thought to be irreversibly lost after brain death and they demonstrate that certain loss of function is reversible, thereby redefining slightly the biological conception of irreversible cell death. But it does not yet change the meaning of irreversible loss of brain function, because the study demonstrates only restoration of function in cells but not the restoration of brain function. Thus, brain death as of yet remains irreversible because there are still no known physical possibilities for the restoration of brain function after brain death. Vrselja et al.'s study does demonstrate, however, how new physical possibilities can be established.

Assuming my argument that biological death is defined by the biological theories of human functioning, then the conceivability of reversal of a certain biological process is grounded

in that theory. In other words, what is possible is based on the relevant knowledge in current biology. If certain kinds of loss of function that lead to death are not known to be reversible, then biological death is irreversible. Irreversibility in biological death is not immutable, however, and the types of processes that we now think are irreversible could become reversible. And once that happens the meaning of irreversibility in the biological definition will change. If the proper domain of irreversibility in the biological definition of death is set by physical possibilities, then irreversibility is disambiguated because irreversibility will apply to only those processes that are currently thought to be irreversible. The requirement for the inclusion of irreversibility into the concept of death is lowered. In order for biological death to be reversible, it only needs to be the case that certain losses of function are currently irreversible and that they lead to death. It need not be the case that death is irreversible in principle or that it is primarily inconceivable for death to be irreversible, as Cole seems to require. Irreversibility specified based on physical possibilities for reversal is likely to be part of any concept of death.

Cole has further criticized the biological definition of death, by stating that its ambiguity prevents us from knowing our obligations to dead individuals. It is important to emphasize that my argument about the concept of death is not an argument about obligations to dead individuals, or any individuals for that matter. Moral obligations are not set based only on biological definitions of human functioning. For example, even if it were known that fifteen years from now, there will be a way of reversing brain death, this alone would not be enough to argue that we have the obligation to cryopreserve brain-dead individuals until it is time for them to be revived. There are a variety of other kinds of considerations that would need to be taken into account in order to determine whether there is an obligation to cryopreserve dead individuals. One could easily see that expenditures required to support such an endeavor might

be prohibitive and might in fact infringe on the care of currently live patients. Thus, a decision to extend limited healthcare resources to preserve dead individuals would have to be considered against the background of a number of other demands for healthcare resources in order to determine whether an obligation to the dead exists and whether it is supportable. Any biological definition of death on its own would not provide sufficient ground for a decision about how to allocate medical care. That our decisions about how to treat dead individuals are not based entirely on biological facts is, I think, partly what motivates Veatch (2005) to argue that death is not a scientific, but a moral, notion. I disagree with Veatch, and I think that one can isolate a primarily biological notion of death, but I agree with him that moral decisions about how to treat dead or live individuals does not rest entirely on facts about their biological functioning.

4. Conclusion

In this paper, I showed that death is irreversible. I argued that death is an *a posteriori* concept and that the scope of irreversibility is circumscribed by natural or physical possibilities, not metaphysical or logical possibilities. I showed that death is *a posteriori* by challenging the contention that there is an independent commonsense concept of death. To circumscribe the boundaries of commonsense death, I relied on Lewis's method of collecting platitudes within a particular domain of everyday parlance. I argued that everyday parlance about death contains biological facts for two reasons: First, I took the identification of cardiopulmonary death with a traditional notion of death as an example of where a biological concept of death has been incorporated into everyday parlance and became constitutive of commonsense death. Second, I argued that even when there are differences between commonsense death and biological death,

both laypersons and medical professionals converge on a biological conception of death to make medical decisions.

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