



Independent Cryonics Educators Program

2.5: The various meanings of “death”

It is not possible to fully understand the goal of cryonics without having an intelligent understanding of death. Cryonics is an extension of emergency medicine; it is not a means of disposing of dead bodies. Cryopreserved people are correctly described as “patients” because they need care and treatment to have a chance of returning to health and function.

Webster’s New Collegiate Dictionary defines death as “a permanent cessation of all vital functions: the end of life.” Wikipedia suggests: “Death is the permanent, irreversible cessation of all biological functions that sustain a living organism.”

These definitions are incomplete and leave unspecified the conditions under which the condition or process is “permanent” or “irreversible”. The term “death” is even more tricky. While “death” has an air of finality, “dead” is often used to mean something reversible and possibly transient. We say that “my battery died” or “my car died” without any intention of implying that the battery cannot be recharged or the car restarted under any conditions. “Dead” can mean the same thing as death or it can mean being in an unresponsive state and in the process of reaching a final state of death.

Earlier definitions of death were usually binary: a person is either dead or alive. There is no state in between. What determines being alive or dead is whether or not the “soul” or “life force” has “left the body”. Contemporary medical practice instead recognizes that dying is not an event but a process. Since this process goes through various stages, it has become increasingly standard to distinguish between legal, medical, and biological definitions of death.

Not only are there multiple definitions of death, the idea that life and death are binary has become hard to support. The introduction of CPR, defibrillation, and life support systems showed that medical definitions can be inadequate. The advent of transplantation underscored the point that an organism does not become dead all at once. Different parts of an organism can continue living in the bodies of others.

Clinical death is the medical term for cessation of vital functions. Vital functions are typically identified with the cessation of heartbeat and respiration, though modern resuscitation methods and life-support systems have required the introduction of the alternative concept of brain death.

Legal death is the determination under the law of a particular jurisdiction that a person is no longer alive. In cases where persons have been missing for a sufficiently long time (typically at least several years), they may be presumed or declared legally dead, usually by a court. In most cases, legal death is called by a medical professional. A medical declaration of legal death may be made on the basis of irreversible cessation of heartbeat (cardiopulmonary death), or death determined by irreversible cessation of functions of the brain (brain death). In the United States, each state has laws for determining these two categories of death that are modeled after the Uniform Determination of Death Act. Not all states recognize “irreversible cessation of all function of the entire brain, including the brainstem” to be death, including Arizona, Illinois, Iowa, Louisiana, North Carolina, and Texas.

We can see the problematic nature of the “irreversibility” criterion in the methods for declaring legal death. Cardiopulmonary criteria for death are met when a physician determines that efforts to restart a stopped heart during cardiac arrest are futile, or that no attempt should be made to restart a stopped heart, such as when there is a Do Not Resuscitate (DNR) order. In the latter case, irreversible is understood to mean that heartbeat and breathing cannot return on their own and *will not* be restored by medical intervention. In the latter case, it would be more accurate to substitute the term “permanent” for “irreversible”. In contrast, brain death is a determination that the brain biologically *cannot* be resuscitated. More accurately, the criterion should be “cannot be resuscitated with current technology and methods”.

The inadequacy of currently used conceptions and definitions of death can also be seen in Donation after Circulatory Determination of Death (DCDD). In the case of non-living organ donation candidates who aren’t brain dead, death is declared after five minutes of circulatory and respiratory arrest. Advocates of the DCDD standard claim that it’s reasonable to declare the donor dead due to permanent loss of circulatory and respiratory function.

However, while all functions that cease irreversibly also cease permanently, it is not true that all functions that cease permanently also cease irreversibly. Critics of this standard therefore point out that while the cessation of respiration and circulation may be permanent, it may not be irreversible at the moment death is declared. That’s because if cardiopulmonary resuscitation were performed, it might succeed. Critics also argue that both the statute and biological concept of death require irreversibility, therefore the donor must be alive.

This argument need not concern us, as cryonicists, so long as it does not affect our ability to proceed with cryopreservation. The resolution of the conflict lies in acknowledging the distinction between permanence and irreversibility and in acknowledging the practical need for a criterion that allows for organ donation to proceed despite possible lack of irreversibility.

True death: If irreversibility is taken to be an essential component of the definition of death – not death for legal or donation purposes, but actual death – then we need to refine our understanding of when loss of critical function is truly irreversible.

So long as the law in a jurisdiction forbids us from starting cryonics procedures until after “death”, we want a definition of legal death that allows us to proceed without undue delay. However, if a person is truly, irreversibly dead, there is no scientific or philosophical point in

proceeding. There is a *contractual* reason to proceed if that person has specified that attempts should be made regardless of the extent of damage. This is a crucial point given that we may disagree over whether a specific condition is irreversible.

After separating irreversibility from permanence, the next step in understanding real death is recognizing that what is currently reversible depends on the level of technology and expertise at any particular time. Before the second half of the twentieth century, when respiration and circulation ceased, the person was considered dead because no way was known of resuscitating them. After the advent of CPR, cessation of function became something to treat because it was now potentially reversible.

Even more drastic cases of cessation of function or lack of metabolism are now understood to be insufficient to conclude that death has occurred. Scientists observed that some organisms periodically enter and recover from states of reduced metabolism. The extremophile tardigrade (also known as the water bear) can tolerate complete arrest of its normal metabolism. At a less extreme level, reduced metabolism compatible with life can be seen in the use of general anesthesia and therapeutic hypothermic circulatory arrest. This shows that humans can be cooled to profound hypothermic temperatures (as low as +18 °C or even +9 °C in one case) with stoppage of brain electrical activity and can be recovered with no adverse neurological consequences.

Information-theoretic death: Given all these considerations, cryonicists favor an information-theoretic criterion of (true, final) death. This has been defined by Ralph Merkle:

“A person is dead according to the information theoretic criterion if their memories, personality, hopes, dreams, etc. have been destroyed in the information theoretic sense. That is, if the structures in the brain that encode memory and personality have been so disrupted that it is no longer possible in principle to restore them to an appropriate functional state then the person is dead. If the structures that encode memory and personality are sufficiently intact that inference of the memory and personality are feasible in principle, and therefore restoration to an appropriate functional state is likewise feasible in principle, then the person is not dead.”

It should now be clear that a person can be considered legally and clinically dead and yet not be truly dead. Consider the situation where someone today is pronounced dead. If this is based on the common definition of death as “a permanent cessation of vital functions”, then if a cryopreserved person is revived in the future, then there has been no permanent cessation of vital functions. Therefore, by this definition, if cryonics works and a cryopreserved person is awakened in the future that person was never dead according to the common dictionary definition of “death,” even though they were *legally* dead.

The indicators use to determine death have changed over time. It used to be when breathing stopped. Then death was determined by cessation of heartbeat. In some cases, it may be cessation of brain function. The information-theoretic criteria recognizes that technological capabilities change over time. Current criteria are transient. The person is only truly dead when no means exist, even in principle, of ever restoring a person to life and function.

References

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