

REVIEW ESSAY

New Books and Points of Discussion in the Halakhic Definition of Death: *Respiratory-Brain Death* by Avraham Steinberg, and *Defining the Moment—Understanding Brain Death in Halakhah* by David Shabtai

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Biography: Noam Stadlan is a neurosurgeon and Assistant Professor of Neurosurgery at Rush University, Chicago IL. He has written on the definition of death both in *halakhic* and medical literature. His article, “Conceptual and Logical Problems Arising from Defining Life and Death by the Presence or Absence of Circulation” appeared in *Meorot* 8, 5771 (2010)

Abstract: Two recent books advance different halakhic definitions of death. Avraham Steinberg presents a strong case for Respiratory Brain Death (RBD)—the irreversible cessation of respiration in the context of irreversible cessation of brainstem function and consciousness. Despite some flaws, RBD appears to be the more logically valid definition and its consistency with halakhic sources is as good as that of other definitions. David Shabtai takes an encyclopedic approach, presenting a wide spectrum of opinions and offering valuable insights, but ultimately fails to critique adequately the definition of death as “the cessation of vital motion.” His representation of the scientific data is at times misleading and inconsistent with biomedical sources. While Shabtai’s book is a valuable collection of halakhic material, his analysis and conclusions should be understood as a partisan argument. Ones seeking a balanced analysis of the topic will need to augment the book with other sources.



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New Books and Points of Discussion in the Halakhic Definition of Death: *Respiratory-Brain Death* by Avraham Steinberg, translated by Fred Rosner (*Merhavim-Torah Center for Judaism and Education, 2012*), and *Defining the Moment—Understanding Brain Death in Halakhah* by David Shabtai (Shores Press, 2012)*

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When is a person considered dead? Prior to the medical achievements of the mid 20th century, there was no practical need to address this question in depth. When the person stopped breathing and the heart stopped pumping, every bodily function, including neurological function ceased as well. In the era of modern medicine, ventilators can make air move in and out of lungs, hearts can be replaced with machines or transplants, and many different organs can be moved from one body to another. The cessation of a heartbeat and respiration are no longer irreversible and no longer imply the loss of every other function. With the medical advances came the need to develop a theory and criteria defining why a person should be considered alive or dead, and how to make that determination.

A vigorous discussion has taken place over the last 45 years both in the bioethical world and the halakhic world. The bioethical approach

contains two broad positions: one defines the human being as a thinking being(perhaps with an identity) and therefore death is based on the brain/neurological criteria, the other position defines a person as a biological organism, and therefore death is the cessation of integrated function or some function in the body as a whole. This second approach does not give neurological function any privileged position.

While the basis and underlying theory may be different, the above two positions are reflected in the current halakhic discussions, but the halakhic discussion also includes a third position: the irreversible cessation of spontaneous respiration in the context of irreversible cessation of brainstem activity (ICSR) and consciousness. While the specific tests mandated by this definition overlap those mandated by the neurological definition, the difference in underlying justification has significant ramifications.

Two recently published English books address the halakhic definition of death. Avraham Steinberg¹ in “*Respiratory-Brain Death*” presents the case for defining halakhic death as the irreversible cessation of respiration in the context of irreversible cessation of brainstem activity. This is the standard first defined by the Israeli Chief Rabbinate in 1987 and reiterated in the recent Knesset bill in 2008.

David Shabtai² takes a different approach. In “*Defining the Moment- Understanding Brain Death in Halakhab*”, his goal is to create a ‘conversation’ between the various definitions of death. He pledges to ask the difficult critical questions necessary to fully understand the debate, and conduct a no-holds-barred exploration of the issue. He sees his book not as supporting a particular point of view, but as a resource, presenting a large amount of relevant data in a balanced fashion. Given this goal, it is essential to assess not only the quality of the information, but whether the presentation is indeed unbiased.

Shabtai uses two concepts to assist in evaluating the various definitions of death. The first is a concept taken from the bioethics literature³. He quotes Dr. James Bernat’s suggestion that a definition of death requires three parts: a concept of life and death that identifies what exactly it is that makes us an alive human being; criteria for death indicating the state we can identify that corresponds with a person who has fulfilled the definition of death; and tests for death indicating what specific observations or medical tests need to be done and what results need to be obtained for there to be certainty that the criteria have been fulfilled. Shabtai applies this framework to the halakhic sources and tries to identify which parts of the sources refer to which specific levels of the definition. As we will see, this approach may impose a reading on the sources not necessarily intended by the author. On the other hand, it is a very valuable tool for evaluating current definitions of death, and will be even more helpful if future authors consciously fill out the outline and

precisely identify exactly what they mean for each part of the definition.

Ideally, each part of the definition should be logically consistent with the other levels. For example, if the concept of life defines a person as a thinking human being, the criteria for death should be cessation of thinking and someone who fulfills the tests would not have any signs of thought. While the concept of life is not the domain of science or logic, science and logic are necessary to identify if the levels of the definition are logically consistent with each other, and if the tests accurately fulfill the criteria. This has been termed “internal validity.”

Unfortunately the early halakhic sources do not address the realities produced by modern medicine

The second concept involves comparing the results of a definition to results of a situation where the determination is already known, i.e., “external validity.”⁴ The known outcomes can be halakhic or common sense. If the results of a definition of death conflict with an accepted halakhic position, the correctness of the definition is obviously called into question. Alternately, there may be situations where common sense tells us that someone should be defined as alive, but a definition of death defines them as dead. This would not necessarily be a halakhic problem, since the halakhic determination can be accepted and the consequences accepted. Questioning the halakhic determination under this circumstance is actually an appeal to consequences argument, not necessarily one of *halakhab*. I will later illustrate these possibilities.

The above methods of analysis create challenges to every definition of death. In addition to meeting the challenges of validity, halakhic

opinions obviously have to be based on the halakhic sources. Unfortunately, the early halakhic sources do not directly address the realities produced by modern medicine. Unless the rabbinic authors had prophetic knowledge, they based their opinions on pre-modern concepts of medicine and anatomy. The interpretation of the opinions requires assumptions, and it is influenced by the interpreter's position on (1) the impact of modern science on *halakhab*, (2) the fallibility or infallibility of earlier decisors⁵, and (3) whether to understand opinions in the historical context in which they were written, or to impose on them an ahistorical understanding.⁶

Steinberg states his definition of death at the outset:

“when it is medically obvious that a person has no spontaneous respiration at all and is lying motionless like a stone without any consciousness and no movements or reactions (to stimuli), and if there is clear evidence from the medical testing which is reliable and unanimous in proving complete and irreversible cessation of the functioning of the brain and especially the brain-stem, which is the central control of respiration, one has established the condition known as ‘respiratory-brain death’, and this is the *halakhic* moment of death of a human being according to this opinion.”⁷

In this statement it appears necessary to show ‘complete...cessation of the functioning of the brain’. However, the next paragraph states:

“there is no special importance attributed to the whole brain, but only to show that the brain is essential for respiratory activity. Therefore, even if there are individual cells in certain parts of the brain that are still alive, this does not matter nor does it change the basic definition of death according to this approach. In this way, this approach...differs from brain death as defined medically and legally, called ‘whole brain death’, according to which the brain,

which is the center of the central nervous system, determines whether a person is alive or dead.”⁸

Finally, he states that this

“is not a change in *halakhab*...there is no change in the *halakhic* definition of the determination of death since the days of Moshe Rabbenu...the determination of the moment of death ...is based on the complete and irreversible cessation of all spontaneous respiration. Only the instruments and tests by which we determine and prove the irreversibility of the situation have changed: In those days, confirmation of the irreversibility of the cessation of respiration was the absence of a pulse or heartbeat or the case of decapitation in which there is complete separation of the head and the brain from other parts of the body; Nowadays we can also prove this irreversibility by showing complete and irreversible destruction of the brain-stem which controls respiration.”⁹

It is important to emphasize that the cessation of circulation is not necessary in and of itself, but serves only as a means of confirming irreversibility.

There is no change in the halakhic definition of death since the days of Moshe Rabbenu

After a brief review of the history of death in *halakhab* and a review of the methodology of determining death, Steinberg states:

“Currently it is widely accepted that the determination of death according to the criteria of respiratory-brain death (RBD) also requires proof of the cessation of function of the cerebral hemispheres and of the brain-stem...it is...not necessary to show the cessation of function of the various endocrine glands, including the hypothalamus.”¹⁰

Many definitions of 'brain death' mandate that all functions of the brain have to be absent for a person to be considered dead. A number of studies have shown that in some patients, some endocrine function of the pituitary gland and some hypothalamic function (in the form of support for the endocrine function and/or maintenance of stable temperature) can persist.¹¹ If the cessation of all functions is necessary for brain death, these patients cannot be defined as dead.

Steinberg specifically addresses and eliminates these concerns with the above statement. He goes on to write that: "RBD can be determined only in the presence of three clinical findings: coma and absence of any movement whatsoever in response to external stimuli and no spontaneous movement whatsoever; complete absence of all brain-stem reflexes; and complete cessation of spontaneous respiration."

The above paragraph seems to contradict the wording of the RBD act of 2008, section 4(3) and (4)¹² that states that among other necessary conditions, "there is clear clinical proof of the complete and irreversible cessation of the whole brain function, including brain-stem function; and test by devices has proved the complete and irreversible cessation of brain function, including brain-stem function."

No patient who has fulfilled the criteria has ever regained neurological or respiratory function

How does Steinberg justify stating that it is not necessary to show cessation of the function of various endocrine glands including the hypothalamus, while at the same time mandating that there needs to be complete cessation of the whole brain function?¹³ The most likely explanation is that the usage of 'whole brain' in the RBD act is shorthand for what he outlined above. Another option is that the key lies in the words 'clinical proof'. The

output of the endocrine glands goes into the blood stream, and so the function of the endocrine glands could be classified as not clinically obvious. The function of the hypothalamus is not manifested in movement of the body, only control over temperature and other internal bodily functions¹⁴. Therefore hypothalamic function could similarly be classified as not clinically obvious depending on how the word 'clinical' is defined. As a matter of anatomy and physiology the function of the hypothalamus is classified as function of the brain, and it would be beneficial for Steinberg to be more precise. Regardless of the above discussion, the possible presence of endocrine and hypothalamic function has no impact on the coherence of the definition. Under Steinberg's underlying theory, death is the cessation of respiration in the context of absent consciousness and absent brain related movement. The cessation of brain function is only an indicator that these criteria have been fulfilled; it is not, in Steinberg's view, an underlying mandate. Endocrine function and hypothalamic function do not contribute to respiration, consciousness or movement, so persistence of endocrine/hypothalamic function has no impact at all.

Steinberg's definition of death fits well with established medical facts. Patients commonly defined as 'brain dead' will be classified as dead under these criteria. In addition, no adult patient who has fulfilled the criteria he outlined has ever regained any neurological or respiratory function. The question of how it works philosophically and with the halakhic sources will be discussed in conjunction with Shabtai's discussion.

Shabtai's book is more inclusive, covering opinions favoring many differing definitions of death. It can be divided into four parts. The first contains an overview of the medical and bioethical discussions of brain death and a discussion of organ donation. This section is nicely organized, and for the most part understandable to the non-medical reader.

Similar to the RCA's *Va'ad Halakhab* report published in 2010¹⁵, Shabtai uses large portions of the scientific information section in the Report of the President's Council on Bioethics (2008)¹⁶. He also attempts to rebut some of the criticism of the *Va'ad Halakhab* report, which did not include any of the medical and scientific data that supported the concept of brain death. Shabtai mentions the existence of this data, but dismisses it in a short paragraph. The biomedical literature contains hundreds of papers on this topic, and Shabtai's dismissal is entirely without foundation or support from the literature. In addition, he misinterprets some key studies, repeats erroneous assumptions regarding areas of brain function, and assumes that areas of uncertainty are resolved against the support of brain death. One result of his misunderstanding of the scientific data is that his references to the data in the rest of the book (especially regarding blood flow, hypothalamic function, and implications of pathology reports) are frequently inaccurate.¹⁷

The second section of the book reviews the current bioethical discussion of the definition of death. Shabtai reviews the various approaches to defining death by neurological criteria: whole brain death (the entire brain needs to be dead), higher brain death (the cerebral hemispheres, the seat of thinking and consciousness have to be dead, but the brainstem can still function), and brainstem death (the brainstem has to be dead but the hemispheres can still have cellular function). He points out the practical drawbacks of a strict interpretation of the whole brain definition (it is difficult if not impossible to be sure that every cell in the brain is dead) and the various ways that this has been addressed. He notes the philosophical and practical problems associated with the higher brain definition (how to define loss of consciousness, those in a persistent vegetative state could be defined as dead). The British definition of brainstem death mandates irreversible loss of consciousness and loss of brainstem function including respiration. The critique here consists of pointing out that there

is no underlying rationale stated for choosing this combination of findings. In fact, the idea of brainstem death is quite similar to Steinberg's RBD definition, and some philosophical responses will be discussed in that context.

The Va'ad Halakhab report did not include any of the medical and scientific data that supported the concept of brain death

Also included is the current debate on whether neurological function in fact defines human life. The positions taken are very similar (but not identical to) the halakhic positions, and so the discussion is relevant. One point of view, represented by both Truog/Miller and Alan Shewmon, views the essence of life as integrated biological function. While they are somewhat vague as to what exactly constitutes this 'integrated function'¹⁸, they are clear that neurological function is not accorded any special status. The other point of view is that of John Lizza, who states that a human life is more than just integrated biological function, and that neurological function is primary, and in fact controlling.

While the discussion was initiated by the new definition of life given in the President's Council on Bioethics (2008) report¹⁹, it ultimately moves to a discussion of the life and death status of a decapitated human being. Truog/Miller admit that a functioning human body without a head should be considered a human being. In a subsequent paper²⁰ Lizza presents the thought experiment of a decapitated person named Waldo whose head is sustained with artificial circulation and the body is destroyed. Lizza states:

“Miller and Truog could not identify Waldo with the artificially sustained head and maintain that Waldo has continued to exist as an integrated human organism as a whole. They could not say that Waldo had simply acquired a substantially altered circulatory

respiratory system, again similar to someone surviving a heart transplant but only more extensive. Since such a system would be entirely mechanical and not organic, Waldo could not be an integrated human organism as a whole in any sense.... Waldo would therefore be dead. However, since Waldo is still *ex hypothesi* conscious, this implication is highly counterintuitive....what Miller and Truog miss is how the decapitation gambit challenges their assumption that human death can be understood in strictly biological terms as ‘the cessation of the functioning of the organism as a whole.’ The biological paradigm of death assumed in their view entails that Waldo’s life would continue in the artificially sustained decapitated body and not in the artificially sustained conscious head of Waldo...because this conclusion is absurd, the decapitation gambit is a strong reason for rejecting the biological paradigm of death that underlies their view.”²¹

Lee and Grisez take a slightly different approach. It had been noted that the advocates of defining death using neurological criteria have difficulty in identifying which neurological functions have to be present or absent and why.²² In response, they articulated the concept of the radical capacity for sentience. They note: “Since a human being is a rational animal, anything that entirely lacks the capacity for rational functioning is not a human being. Since rational functioning in an animal presupposes sentient functioning, anything that entirely lacks the capacity for sentient functioning also lacks the capacity for rational functioning and so is not a human being.”

And further:

“when an organism dies, its remains usually include many things of different kinds...when someone undergoes total brain death, many things have come to be in place of the individual. One of those things is alive and much larger and far more

complex than any of the usual living parts of the remains of an organism. Nevertheless, that living part of a human being’s remains no longer has the capacity for sentient functioning that is presupposed by the capacity for conceptual thought, reasoning, and free choices....the human being has passed away, and the remains are not a human organism.”

While it appears that Lee and Grisez are arguing for a higher brain definition, in fact they state that death mandates the loss of the radical capacity for sentience, leaving the specifics undefined. They also reference a decapitation model, but with a twist:

“Imagine dicephalic twins (a baby born with one body and two heads- considered in American law and *halakhab* as two people) called Adam and Ben. They have only one abdomen... and two heads. Significantly, their circulatory systems are merged; there is only one circulatory system serving both individuals. (They then imagine a situation where Adam’s head is removed). Ben survives, marries and has children. No one would say that Adam is still alive. But...when a body with its organs continuously functioning remains alive even though it no longer has any brain, the very same individual continues to live. But Adam’s body remains alive with all its organs continuously functioning. Therefore the ongoing continuity of functioning of a big part of what had been an organism does not show that the brainless entity that remains after brain death is the individual it was before becoming brainless.”

The authors then consider organ transplantation, starting with a lung. The lung

“is a living organized unit, and it is human in the sense that it comes from a human being and its cells have the human genome. But it is not part of the individual from which it came, and is not a member of the human species, or any animal species...one can easily imagine that increasingly larger parts

of a donor's body will be transplanted as a unit into a single recipient. One can even imagine a case in which identical twin brothers...Jim suffers fatal brain damage and Joe suffers fatal damage to the torso. But after Jim's death the team transplants his body from the neck down to Joe. After Jim's death and before the transplantation, what was Jim's body? It is an entity of the same sort as the living remains of a brain dead individual."²³

These critiques apply to all definitions of death that are not based on neurological function (Steinberg's RBD definition, since it incorporates brainstem function, avoids these challenges). As will be seen, they are a major and so far unmet challenge for those who define life and death as the presence of circulation, integrated function, or vital motion.

How is the reader to know if a strong point is made on one side that the opposing opinion is quite weak?

The third section of Shabtai's book is an analysis of the classic sources in the Talmud and the *responsa*. He brings lengthy quotes, addresses a particular point in the source, and then presents the opinion of one side and the other. It is indeed beneficial to see the opinions side by side and he discusses many of the standard and some non standard sources. He brings much depth and sometimes neglected sources, and tours some side issues that have bearing on the topic. The amount of material is impressive.

Steinberg also quotes many of the same sources and analyzes them. He mentions alternate understandings, but focuses on his own understanding and in general his analysis is more straightforward and direct. Shabtai includes greater focus on parsing words and phrases. While it seems that Shabtai tries for equality, ultimately his presentation is unbalanced. In the majority of cases, the side

opposed to brain death/ICSR is given the final word. While the conclusion usually includes a statement of uncertainty, the discussion preceding the conclusion more often than not rejects brain/respiratory definitions of death. One reason for this is the limited sources. Much has been written in support of cardiac criteria and in support of neurological criteria. In addition, there have been a number of papers opposing neurological criteria. However, not much has been written pointing out the lacunae in the positions of those supporting cardiac criteria. Shabtai cannot be blamed for the lack of sources. Yet the imbalance is caused not only by the lack of sources, but by his analysis.

The conversation is woven together by Shabtai's comments—and some questions need to be asked: Do all opinions have the same worth? Are some more logically compelling than others? How is the reader to know if a strong point is made on one side and that the opposing opinion, although also presented, is quite weak?

The Babylonian Talmud, Tractate *Yoma* (85a) presents two options to determine the presence of life: checking the nose (for breathing), or checking somewhere on the chest/abdomen (either for breathing or perhaps for heart pulsations). Rashi there opines that checking the chest is the sign of life—interpreted by many as stating that circulation is the ultimate sign of life. Shabtai interprets the *gemara* to discuss the *tests* for death, and Rashi as establishing that circulation is the *criterion* for death. Two of the main sources for *halakhab*, Maimonides and the *Shulchan Arukh*, also cite the nose in their discussion of death, without any mention of the heart or circulation or Rashi. Steinberg and those supporting respiratory and/or brain criteria take these sources at their word: The definition of death is the irreversible lack of respiration. However, Shabtai states that:

“neither Rambam [Maimonides] nor Shulchan Aruch, in codifying these rulings, explicitly argue with Rashi, leading to the conclusion that Rashi's approach is and has always been normatively accepted.”

In other words, Shabtai wants us to think that opinions that don't even mention the term 'circulation' are in fact arguments in favor of using circulation as the definition of life. While this argument from silence is a possibility, it is certainly not compelling. Nevertheless, Shabtai presents it towards the end of the section as a statement of fact and the uncritical reader will naively accept it as well. This problem is repeated throughout the book.

Opinions that don't even mention the term 'circulation' are arguments in favor of circulation as the definition of life.

It may be useful to identify all the unstated assumptions that have to be true for Shabtai's conclusion to be valid:

1. Rashi's opinion is based on the term '*libo*' in the *gemara*. There are actually variant texts of the *Gemara*; one does not mention '*libo*' at all. So we would have to assume that the text with the term '*libo*' has to be the halakhically meaningful one. This is by no means clear- only the Meiri in addition to Rashi among the *Rishonim* have that particular text. In addition, the *Yerushalmi* does not contain it.²⁴
2. We would have to assume that the *Gemara* meant heart when it stated '*libo*.' R. Daniel Reifman notes²⁵ "a survey of instances of the term *libo* in tannaitic sources shows that in virtually every other context in which it refers to a part of the body (as opposed to a state of mind)..... *libo* is always used idiomatically to refer simply to the external chest area, with no connection to the heart organ that lies beneath."
3. We would have to assume that Rashi meant heart, rather than signs of respiration at the chest²⁶. It is very reasonable to understand Rashi as indicating the movement of the chest is

testing for breathing rather than heart function.

4. Rashi's understanding of physiology placed the heart as part of the respiratory system.²⁷ Therefore, if Rashi indeed meant heart function, he could have been referring only to the respiratory function that was connected to the heart as he understood it. Circulation produced by the heart had not yet been described, and automatically interpreting Rashi's 'heart' as circulation is imposing today's knowledge on a 1000 year old position.
5. Dr. Bernat's paper delineating the three aspects of death was published in 1981. In the ancient world, it may not have been clear that a specific delineation of definition/criteria/tests was necessary. Shabtai assumes that Rashi was aware of this, specifically identified the *Gemara* as describing tests (and not criterion- see discussion above), and established circulation specifically as the criterion for death
6. We would have to assume that the Rambam and the *Shulhan Arukh* were similarly aware of the nuances of Rashi's position regarding tests and criteria, and how he differed from the plain reading of the *gemara*.
7. And finally, we would have to assume that Rambam and the *Shulhan Arukh*, by not mentioning Rashi at all, indicate that they agree with him. We would have to assume that by mentioning only respiration in their discussion of death, the Rambam and the *Shulhan Arukh* have agreed that the criterion for life and death is circulation. This is obviously quite a logical stretch. The most straightforward assumption is that Rambam and *Shulhan Arukh* meant what they wrote, and if they had wanted to include circulation they would have explicitly done so.

Thus Shabtai's statement could be true, but clearly it is not the most logically compelling understanding of the sources, and requires many poorly founded assumptions.

The first section of part four is an analysis of the opinion of Rabbi Moshe Feinstein. R. Feinstein published four *responsa* on the topic and also issued a letter which was published posthumously. The *responsa* have been understood in various ways, and Shabtai tries to bring them together to make a coherent whole—ultimately concluding that his position is in doubt (“*safeke*”). However, the letter explicitly states that a patient fulfilling Harvard criteria for brain death is halakhically dead. In addition, the letter states that continued heart function in this context is not halakhically relevant. The position of the letter is quite clear.

Shabtai states that “some have questioned the authorship of the letter.”²⁸ The authors of the RCA document go significantly further, writing that “It is generally agreed and uncontroversial that this letter was not penned by Rav Moshe.”²⁹ The documentation is a reference to some correspondence although the contents of this correspondence is not revealed or offered for inspection.

Rambam and the Shulhan Arukh do not mention Rashi at all

This is a serious accusation of fraud and should not be made or taken lightly. If it was fraud, the perpetrators would have had to come from the circle close to R. Feinstein. If evidence exists for fraud, it should be made public. If there is no evidence, the accusation should be retracted and apologies made. Furthermore, if the letter accurately reflects R. Feinstein's position, it actually makes no difference for the purposes of the discussion who in fact penned the actual words.

Shabtai also cites the opinion of Rav Shlomo Zalman Auerbach regarding the letter. R. Auerbach interpreted the letter as indicating when ‘life support’ machines could be removed, and not indicating when a person was dead. Daniel Reifman cogently points out that this interpretation likely reflects R. Auerbach's own position being projected onto the letter, rather than the real meaning of the letter.

R. Feinstein's third *teshuvah* also supports the concept of brain death. Shabtai writes about the possibility that the case under discussion involved not a patient with a heartbeat, but someone without a heartbeat, and therefore it doesn't apply to a brain death patient whose heart is still beating. However, the *responsum* mentions injecting a radio-isotope to determine if there is still a connection between the head and the body. Blood flow is required to move the isotope around the body. Therefore, if R. Moshe had even rudimentary knowledge of how the isotope study worked, the possibility that Shabtai raises makes no sense.

The above is another example of how opinions are stated without making the reader aware of the plausibility or implausibility of the opinion. Steinberg's analysis of R. Feinstein's opinions and others such as Reifman's³⁰ are less detailed, but do not require dismissing parts of R. Feinstein's work and do not require significant suspension of logic.

The middle portion of part four discusses other opinions from the 1980's up to the current time. The final section presents the case for a non-neurologic definition of death and ends with critiques of the neurological/respiratory definitions of death. The table of contents gives a hint of where the author's presentation will lead. The chapter discussing the non-neurological definition is entitled: “Cardiac Function and Vital Motion”, whereas the following chapters are titled: “Challenging ICSR as Determinant of Death” and “Opposing Brain Death.”

The idea of defining *halakhic* life as the presence of vital motion was first posited by Rabbi J. David Bleich, and his position is the central topic of that chapter. The passage in *Yoma* suggests that breathing is the definition of death, and for some, Rashi's commentary adds the suggestion of circulation. The *Mishnah Ohalot* 1:6 suggests that decapitation (absence of the head) is the definition of death. Shabtai states his opinion that "The definitions and criteria that *Hazal* (the Talmudic Sages) employed to determine death are therefore relevant, accurate, and obligatory today—even while the practical applications of these principles is perhaps more complicated than in the past."

This would seem to indicate that the three criteria under consideration are respiratory, neurological and circulatory. However, in the beginning of the book, Shabtai identifies the three main suggestions for defining death halakhically as: the complete and irreversible inability to breathe on one's own (irreversible cessation of spontaneous respiration), the complete and irreversible cessation of all bodily motion (including heartbeat), and the complete absence of the head. This classification represents a very significant difference. What exactly is "the complete and irreversible cessation of all bodily motion" and how did it wind up in Shabtai's list?

Shabtai accurately notes that defining life and death by circulation alone no longer makes sense. Circulation can be provided to any tissue by artificial hearts and pumps, so that if the definition is to have validity, a pump attached to any piece of tissue, be it an arm, leg or big toe would have to be considered alive. He further states that "Those who posit strict cardiac criteria for death rarely analyze their positions from this perspective. It is likely, however, that in the final analysis, they would agree with and adopt R. Bleich's (concept of vital motion)."

Without references, further discussion, or a stated basis for his opinion, Shabtai assumes

that rabbis over hundreds of years would change not only their tests for death or criteria to determine death, but their actual concept of what life and death really mean. It is quite a sweeping statement of opinion with no stated justification. Furthermore, some of the authorities quoted in the book who define death using circulation, such as Rabbis Shmuel Wosner, Yosef Shalom Elyashiv and Herschel Schachter, have never issued any such statements. Finally this idea contradicts Shabtai's statement that the definitions of death established by the rabbis of the Talmud are obligatory and therefore cannot be changed. If the rabbis felt that the definition of death as the cessation of circulation was based in the Talmud, an argument from consequences should have no effect.³¹

Shabtai accurately notes that defining life and death by circulation alone no longer makes sense

As Shabtai noted, one way to salvage the circulation definition of death is in fact to change it to the position of R. Bleich's concept of vital motion³². This is defined as "any clinically observable or perceivable movement that promotes the continued viability or health of an organism." This concept has very little to do with circulation (other than circulation may be needed to have 'vital motion', but circulation by itself is not enough to be considered life). Shabtai explains that R. Bleich "capitalized upon the Mishnah's unstated assumption that motion is always a sign of life."

This is the *Mishnah Ohalot* 1:6, which describes a decapitated body as dead, even if there is still some movement in the body. Since it is possible for there to be movement in a dead body, R. Bleich concludes that the *Mishnah* assumes that motion is a sign of life, and therefore it was necessary to explain how motion in the case of decapitation is not a sign of life. In addition, it is not just any motion, but R. Bleich assumes the unstated principle is 'vital motion'. While

this is a possible explanation, there are a number of other ‘unstated assumptions’ that would fit just as well. For example, the unstated assumption could be that muscular jerking movements of the body when not controlled by the head are not a sign of life. It could also mean that anything that the body does below the head is not significant to human life.

R. Bleich assumes that the *mishnah* was teaching that body movement that is not ‘vital motion’ is not a sign of life. One problem with this concept is that despite his explanations of blood gushing out through cut arteries, circulation of oxygenated blood still exists in the decapitated body, at least for a few seconds, and muscle function and heart contractions continue for at least a few seconds. Therefore the ‘vital motion’ does not cease contemporaneous with the decapitation.

Another problem is that as far as we know, the internal circulation and interaction of vital motion was not known to the rabbis of the Talmud in the same way that they were probably unfamiliar with the specifics and details of neurological function.³³ More problematic is that Shabtai accepts R. Bleich’s statements and construct without asking ‘the difficult critical questions.’

Shabtai accepts R. Bleich’s construct without asking the difficult critical questions

Defining life by the presence of ‘vital motion’ raises numerous questions, some asked by Shabtai, but none of them discussed as problems in any detail. What exactly is “vital motion”? R. Bleich states that vital motion has to be present in an organism- what does that mean and what anatomy or function has to be present for there to be an organism? Is the vital motion equal to the organism? In other words, if the implications of vital motion depend on the presence of an organism, what is the

definition of an organism and how can one be identified?

Furthermore, what exactly are the tests to determine if ‘vital motion is present? Rabbi Bleich has never stated which particular tests need to be done in order to determine if vital motion is present or absent... The closest he seems to get to specific tests is to state that someone is dead when the heart has ceased to pump long enough for vital motion to cease. This is tautological. Vital motion is never precisely defined, and the tests and results necessary to know that ‘vital motion’ is absent cannot be stated without including the concept of ‘vital motion.’ Essentially, the statement reduces to “the patient is dead when the heart has stopped long enough for him to be dead.” Obviously, this does not provide significant guidance.

Shabtai mentions some of the logical problems with R. Bleich’s idea, noting that according to R. Bleich a body without a head, as long as it had circulation and air was pumped into its lungs, would be identified as a still alive human being.³⁴ But how would he address the other challenges of Lizza and Lee/Grisez? Could one produce two Waldo’s from one person, one a head and one a body? On a more simple level, it seems that the heart and lungs provide vital motion. When the heart and lungs are transplanted from the collection of tissue that is Reuven to the collection of tissue that is Shimon, does the recipient become the donor? What tissue exactly is necessary for Reuven to be and remain Reuven? R. Bleich’s concept in fact fails to address this and other identity related problems. Unfortunately the book does not acknowledge any of these as significant problems.

In contradistinction to the easy pass he gives R. Bleich, Shabtai examines the idea of defining death as the absence of respiration and asks appropriately difficult questions. He notes that if the absence of spontaneous respiration

(ICSR) is the concept of death (breathing supplied by a ventilator machine doesn't fulfill the criteria for life), then anyone who has suffered a spinal cord injury, is on a breathing machine, and cannot breathe on their own has to be considered dead. He devotes an entire chapter to this discussion, mentioning the actor Christopher Reeve as an example.

Shabtai asks: How can someone who is conscious, talking and moving his head be considered dead? This is a valid question. Definitions of death, when applied to situations where we have a good idea of what the results should be, need to correctly predict those results, or else be modified or discarded. In addition, a definition of death should identify a person who is conscious and talking, i.e., has clinically identifiable brain function, as being alive.

One approach would be to apply the *mishnah* in *Ohalot* and conclude that any function below the head does not qualify as function. Therefore, the only cessation of respiration that counts is if it is caused by damage to the respiratory centers in the brain. Steinberg offers an alternate solution: There are entry criteria for being considered dead. In other words, if we find that a person exhibits certain functions, there is no possibility for them to be considered dead. Based on a number of sources, Steinberg states that a person is a candidate to be considered dead only when there is an absence of consciousness and an absence of voluntary movement. Shabtai criticizes this contention, and provides alternative explanations for the sources brought. Even though Steinberg's position is grounded in sources, the logical problem remains. He claims that respiration is the ultimate and only criterion for life and death. However, in order to be dead, one also has to be unconscious and lack brainstem activity. This still appears to be a contradiction.³⁵

Shabtai's point is based on a reductionist concept of life and death, i.e. there is one and only one ultimate concept of life. However,

other options exist. Winston Chiong³⁶ defined a non-reductionist concept, where life is defined as a number of intersecting circles of characteristics of life. As long as the person maintains at least one of the characteristics, he is considered alive. Hence a person is alive if he has one of the following: consciousness, brainstem activity/movement, or respiration. He is only dead if he lacks all three.³⁷ If Steinberg maintains a reductionist approach, he will need to address Shabtai's excellent question.³⁸

How can someone who is conscious, talking and moving his head be considered dead?

Every definition of death faces challenges. The RBD outlined by Steinberg fits very well with the plain meaning of the *gemara*, Rambam and *Shulhan Arukh*. Support can also be found in the *teshuvah* of the Chatam Sofer (who does not mention Rashi at all). The plain reading of Rav Moshe Feinstein's third *teshuvah* as well as the letter also support this. Logically, it is necessary for Steinberg to decide if he indeed uses a reductionist position identifying respiration as the sole criterion for life. If he does, he needs to answer Shabtai's challenge. Aside from this challenge, RBD has both excellent internal validity and external validity. The criteria and tests proposed identify a population as dead that coheres well with expected results.

The definition of death as the cessation of vital motion requires the assumption that Rashi's view is halakhically controlling. It requires accepting the unstated assumptions that Rambam and *Shulhan Arukh* agreed with Rashi despite the lack of any mention of circulation or heart function in their discussion of death. The *teshuvah* of the Hakham Tzvi supports this view (although he also had a premodern idea of medicine and the same questions asked of Rashi regarding the implication of heart function-respiratory or circulatory- can be asked of him). Support can also be found in the Hatam Sofer's

*teshuvah*³⁹. Many recent *poseqim* support defining death by the cessation of circulation, but it is not at all clear that they would support R. Bleich's concept of vital motion. From a practical point of view, R. Bleich has not identified the tests required to determine if vital motion is present. In fact, he has not given a full definition of vital motion that can be applied in various clinical situations. His definition of death is actually useless as a matter of practical *halakbah*. If and when he fills out all three tiers of the definition completely (concept, criteria, tests), the full internal validity of the definition can be assessed.

Shabtai's point is based on a reductionist concept of life and death—there is one and only one ultimate concept of life

The approach also suffers from problems with external validity. As presently constituted, it lacks a basis for identifying a person or what is an organism, and therefore is vulnerable to the critiques of Lizza and Lee/Grisez. In the halakhic realm, it fails to distinguish why a baby born with two heads is considered twins, how to address which is the donor or recipient in a heart/lung transplant (it could be claimed that the vital function of one person is being transferred to a new body, and that the person who is the source of the vital function continues to live), as well as other personal identity issues. Lastly, it fails to address the prospect of creating two people out of one⁴⁰.

The positions of the current Sephardic Chief Rabbinate and Rav Ovadiah Yosef illustrate another aspect of the complex nature of this issue. In his book, Steinberg includes a letter of support from Rav Amar that is also signed by Rav Yosef. The letter states that death occurs with the death of the brain in its totality, including the brain-stem and the irreversible cessation of respiration. Rav Yosef also required that "any person...be given the...right to request

that...no organs be removed from him...until after the cessation of the heartbeat."⁴¹ The clear implication of the added paragraph is that they realized that patients declared dead by the first approach would and could donate organs. In addition, the council of the Chief Rabbinate issued a protocol confirming that the RBD act approved by the Knesset meet the requirements of the Chief Rabbinate dating back to 5747, the date of the first ruling of the Chief Rabbinate on this issue.⁴²

Despite this seeming support for RBD and organ donation, Shabtai quotes R. Ovadiah Yosef's grandson as making it quite clear that R. Yosef absolutely forbids organ transplants⁴³ In addition, he quotes R. Amar as stating in a lecture that a beating heart would appear to preclude a determination of death⁴⁴. On the other hand, R. Amar was widely and publicly quoted as supporting organ donation by Avi Cohen, a brain-dead soccer player.⁴⁵ It is difficult to understand how these variant understandings have appeared. It is reasonable to expect that in a matter literally of life and death there would be some control over the message and some desire for consistency.

One possible explanation was supplied by Ha'aretz.⁴⁶ Ultimately, if these rabbis felt that RBD was not death and that organ donation was not allowed, it is reasonable to assume that they would stand up and state that it constitutes murder, and publicly and vocally disassociate themselves from the RBD act as well as any statements suggesting support for organ donation. Yet they have not done so, thus it is reasonable to conclude that in fact they support the act, and that the other statements are fueled by non-halakhic concerns.

Steinberg has written a straightforward book laying out the case for RBD. Shabtai has assembled a very impressive collection of facts and analysis. The use of concepts from bioethics in analysis is a great step forward in the halakhic discussion. His book is an excellent source of information and some

opinions, but as has been illustrated, the presentation and analysis is biased and uneven.

Shabtai included a number of letters of approbation both in the book and on his website. One is written by his teacher, R. Bleich, who is a vocal and vigorous critic of brain death. R. Bleich writes:

“...The author has succeeded in presenting positions he knows to be erroneous in the most plausible light possible, in present arguments he knows to be specious in as cogent manner as possible, and in presenting purported facts that strain credulity in as credible a manner as possible.... the reader cannot attain edification by simply reading the work.... (But) must read every word with care and reflect diligently upon what he has read.”

R. Bleich need not to have worried, but his concerns are actually reversed. Despite the statement in the Epilogue that “it was not my intention to advocate or adopt any particular approach”, the uncritical reader without outside knowledge will be led to the erroneous conclusion that there is little support for defining death using respiratory or neurological criteria. He will not know of the biomedical information supporting brain death; he will lack the critiques of organismal definitions of life; he will not examine the assumptions or ask the unasked questions. The reader who *does* ask the questions that do not appear in the book, and who *has* outside knowledge will be the one to identify the problems in presentation and analysis and challenge the positions of R. Bleich.

The halakhic analysis of the definition of death depends a great deal on the person providing the analysis⁴⁷. If Shabtai is indeed committed to a dispassionate presentation of the data, it is reasonable to expect that his future writings and recordings will address the shortcomings identified here. On the other hand, if R. Bleich is correct, and Shabtai has a point of view that he has attempted to overcome, it is in the best

interests of the reading public that he divulge his biases and pre-existing attitudes, and let the public decide if he has been dispassionate or not. On a topic as momentous as this, a presentation labeled as unbiased needs to be exactly that, and the reader deserves to know where the author truly stands.

Appendix

Many papers have been published describing various findings in patients who have been determined to be ‘brain dead.’ While there are no universal criteria for ‘brain death,’ all mandate a clinical finding of irreversibly absent brainstem reflexes and an absence of breathing (apnea). Some criteria mandate blood flow testing, others do not. Some mandate testing for electrical activity in the brain (such as EEG or BAER), others do not.

Patients can fulfill the criteria for being brain dead but retain some blood flow to the brain

Patients can become ‘brain dead,’ i.e., lose all necessary neurological function to fulfill a set of criteria, through a variety of processes. The majority have large amounts of brain damage that result in swelling of the brain. This swelling causes increased pressure in the skull (intracranial pressure - ICP). Because of the increased pressure, it is more difficult for blood to flow into the skull, resulting in less blood flow (cerebral blood flow - CBF). When the blood flow is not adequate to sustain all the cells in the brain, more damage occurs. When this process is unchecked, a positive feedback mechanism ensues, wherever increasing ICP causes ever diminishing blood flow until there is no observable blood flow, and massive brain damage ensues, to the point that the patient fulfills criteria for being ‘brain dead.’

Other patients do not enter such a cycle, but suffer damage to the neurons via lack of oxygen, transient decreases in blood pressure (such as patients whose hearts stop and the

circulation is restarted after a time via CPR), poisoning, or other mechanisms. In these situations the damage to the neurons can be out of proportion to the damage suffered by the supporting cells (the glial cells) in the brain. Since damaged glial cells contribute most to swelling, the amount of swelling in this circumstance does not always rise to a level sufficient to enter the positive feedback loop of increasing pressure and decreasing blood flow. However, if enough of the brain cells have been damaged, these patients can still fulfill the criteria for being brain dead, but retain some blood flow to the brain.

It should be kept in mind that the purpose of brain death criteria has always been to identify the patients who have suffered the irreversible loss of key brain functions and apnea. Most criteria for brain death are not designed to identify patients who in addition to the above, also lack blood flow, lack EEG activity, hypothalamic activity and endocrine activity. By performing additional tests, it is possible to identify patients who lack all these functions and findings. Instead of addressing this 'ideal' group of patients and asking the question "are they halakhically dead?", Shabtai addresses the data generated from patients determined brain dead by lesser criteria. He argues against the general concept of brain death by using data and results generated by what could be termed non-ideal or non-maximalist criteria.⁴⁸

As noted, the criteria for brain death focus on determining the irreversible loss of functions of the brain, they do not focus on the status of individual cells. However many articles have been published that attempt to characterize the cells in the brain of the brain dead patient. Are the cells in the brain 'alive' or are they 'dead'? A live neuron requires blood flow, uses energy (and therefore produces heat), consumes glucose and oxygen, and produces waste products and carbon dioxide. Neurons are extremely sensitive to lack of blood flow and in situations where there is a lack of blood flow, permanent damage begins within five to ten

minutes or less. It is also important to keep in mind that the brain contains billions of neurons, and it is impossible to investigate each one. Studies therefore usually focus on detailed descriptions of small groups of neurons, or descriptions of the brain as a whole. The descriptions of the brain as a whole may or may not apply to each and every specific neuron, but they can describe the condition of the vast majority of neurons.

Another method of determining the status of a cell is via staining at autopsy. Sections of the brain are immersed in various chemicals, and then examined under the microscope. It should be kept in mind that the cells in the brain usually are already dead prior to staining. Through various staining methods, the pathologist tries to determine what happened to those cells prior to the person dying, i.e., the point when all would agree that the patient is dead, which does not require a specific definition for the purposes here. For example, there are a certain set of changes that the neurons undergo over time when a person has suffered a stroke. By identifying those changes, the pathologist can determine the age of the stroke (within limits) and which cells would be expected to be alive and functioning, and which would not.

Not every cell identified as 'not dead' by staining is actually alive

Shabtai references a particular report on the neuropathology of brain death four times⁴⁹. Published in 2008⁵⁰, this study reported on the pathology findings in the brains of 41 patients who fulfilled the criteria for brain death. The brain tissue samples were stained with a standard stain (Hematoxylin and Eosin, (H and E)), and moderate to severe changes in the neurons in various parts of the brain were identified, with percentages of ischemic (due to lack of circulation/oxygen) changes ranging

from 37% in the midbrain to 68% in the occipital lobe. In other words many of the cells did not exhibit staining characteristics usually identified with dead cells. Up to 63% of the midbrain cells did not appear to be dead by this staining method.

Yet this finding does not imply that the 'normal' appearing cells were alive. The microscopic changes that result in a cell being identified as dead sometimes take time to develop⁵¹. In the 2008 study, less than 36 hours elapsed between the determination of death and the discontinuation of the ventilator. In patients where more time had elapsed between the determination of death and the cessation of ventilation, there were findings of greater neuronal damage, and in fact the amount of damage correlated with the time after the determination of death but prior to discontinuation of the ventilator. The patients whose bodies were supported for a longer period of time after brain death exhibited greater amounts of cellular damage in the brain. Changes in cells that are interpreted to mean that the cell has died actually take time to develop before they are noticeable with this particular staining method. The cell can be dead but only later does it stain as if it was dead.

Hence not every cell identified as 'not dead' by H and E staining is actually alive. The authors of the study in fact state specifically: "we recognize limitations with the use of routine staining methods, and more specific stains may have uncovered more cellular injury." It should be kept in mind that the criteria for neuronal damage seen on H and E staining were developed in the context of conventional brain injury, not in the context of the situation of brain death. One paper reviewing staining options stated: "because progression of post ischemic changes depends on the severity and duration of ischemia, the pathology observed can only be reliably interpreted under their specific standardized experimental conditions"⁵² In other words, in 'normal' situations such as stroke when circulation continues to the rest of

the brain, accurate conclusions can be drawn from how a cell stains.

However, under the circumstances of cerebral circulatory arrest, which usually (but not always) accompanies the determination of brain death, the usual progression of staining changes does not always occur, or can occur at a different rate. So the usual conclusions drawn from how a cell stains cannot be drawn under this different set of circumstances. It is probable that in the specific unique physiological context of cerebral circulatory arrest and accompanying brain death, many cells identified as 'not dead' on H and E staining are actually dead, but the staining method is not adequate to identify it accurately. An accompanying editorial to the report states exactly that:

"The assessment method used by the authors is a fairly late development in the course of neuronal necrosis [the changes they were looking for occur over time]. More advanced techniques (a list is given) could provide earlier indications of irreversible neuronal damage."⁵³

Shabtai references this editorial and comments:

"Those authors do not, however, offer a philosophical, ethical, or medical basis for selecting one set of criteria over another."

Shabtai's statement is wrong. The authors are correctly noting that 'not dead' on H and E staining does not necessarily mean alive, and that other staining methods may be more accurate in this context. Many staining methods are in fact available that would be theoretically more accurate and a study of their use in examining brains after brain death would shed much light on the topic.⁵⁴

The correct conclusion to be drawn from the paper is also stated: "It has become much less likely for the neuropathologist to confirm brain death."⁵⁵ This paper illustrates that H and E staining using this time window shows that a significant number of neurons are classified as 'not dead'. The pathologist cannot confirm brain death, and given the constraints of the

study timing and choice of stains, he can say that a certain average percentage of neurons are dead. Whether the rest of the neurons are alive or not is unstated, and the conclusion that the rest of the neurons are alive is an unsupported assumption. There is good reason to believe that the staining method used under these specific circumstances significantly underestimates the number of actually dead neurons. Pathological staining is only one way to determine the life/death status of a cell. Others measures include looking at the metabolic activity of the cell, energy usage of the cell, heat production, biochemical composition and milieu, and blood flow.

Shabtai also states “A number of reports purport⁵⁶ to demonstrate that the brain cells of ‘dead’ brains should be described as dead.” Indeed, studies have identified the following conditions in the brain dead patients with no blood flow to the brain on studies:

1. absent brain tissue oxygen levels (oxygen is necessary for the cells in the brain to survive)
2. zero or near zero brain tissue glucose levels (glucose is the fuel used by the cells, and no fuel means that the cell cannot survive)
3. no oxygen utilization and no carbon dioxide production (Functioning cells use oxygen and produce carbon dioxide. The absence of this process indicates that function has ceased as best as can be determined)

These findings are consistent with a metabolically dead brain. For a cell to keep itself alive and maintain the integrity of the cell membrane (the outer wall), it needs to use energy. Under normal and near normal temperatures, and in the absence of any drugs that protect the cells, the cells die quickly when they are not metabolically active. Therefore, it is reasonable to conclude that cells with zero levels of oxygen and glucose, high levels of accumulated waste products, and an absence of molecules that the body utilizes in energy use

and production, are either dead, or in the process of dying. And, if the blood flow is not quickly reestablished, those in the process of dying will complete the process.

However Shabtai states that ‘these studies probe only the outermost 1-3 cm. of brain tissue’, and that ‘the[se] outermost layers of brain tissue would logically ‘die’ first given low or even apparently absent cerebral perfusion....none of these biochemical studies have any relevance to deeper brain structures....’. This claim is patently wrong and is contradicted by anatomy, physiology, and multiple studies.

The question is whether these findings can be generalized to the brain as a whole

One study of oxygen levels in brain tissue, making a statement based on previous animal studies, contradicts Shabtai specifically: “when PbtO₂ (oxygen level in brain tissue) is measured in normal-appearing white matter the value appears to reflect global brain oxygenation”⁵⁷. In other words, the findings from one part of the brain actually do reflect the findings in the entire brain. The study also states that “all patients who developed brain death had PbtO₂ of 0 mmHg at the time of brain stem testing, and when PbtO₂ decreased to 0 mmHg it did not recover in any of the cases.” In short, there was a perfect correlation in this study between absent oxygen levels in the brain tissue, and loss of all observable brain function of the brain as a whole. Again, the tissue oxygen levels correlated with the function of the brain as a whole, including the brainstem.

Another study not cited by Shabtai concludes that, “It is remarkable that at the moment of...brain death, a sharp decrease of PbrO₂ (levels of oxygen in the brain tissue) to levels just higher than zero is seen...SjO₂ (the amount of oxygen in the jugular vein⁵⁸) increases at the cessation of circulation.”⁵⁹ There was a correlation between the loss of brain function

and the levels of oxygen in a small sample of tissue decreasing down to essentially zero. Additionally, this was accompanied by increased oxygen in the venous blood which indicates that the brain ceased to extract oxygen from the blood.

Shabtai also misstates a fundamental aspect of blood flow to the brain. The vessels enter the brain from the surface and then travel deeper. Therefore, if the blood flow is so inadequate that the cells on the surface have died, the cells which are deeper, even further away from the source of blood flow, will receive even less blood flow, and will certainly have died. This is actually the reverse of what he claims. He states that the cells on the surface logically die first when the flow is absent. While there are a number of factors determining rate of cell death (e.g., susceptibility to low/no blood flow, availability of collateral flow, etc.), if the cells at the surface are not receiving blood flow, the cells further down the arterial river are certainly not receiving blood flow. There are further important aspects of blood flow that will be discussed later. But there is also an absence of a discussion of the underlying pathophysiology, and an understanding of how those cells have come to be dead.

The cells in the reports Shabtai references didn't spontaneously die. In all or the vast majority of the cases, the cells died because the blood flow was not adequate to supply the needs of the cells. He is accurate in stating that some of the tests look at only a small sample of cells and these are found to be dead, but the question is whether these findings can be generalized to the brain as a whole. The studies referenced earlier supply clinical proof that the findings indeed can be generalized.

There are two other reasons for answering this question in the affirmative. As noted, the blood supply to that area of the brain under investigation was inadequate, leading to the death of the cells. It is reasonable to assume that anywhere the blood flow is similarly inadequate, the same process will occur, and the cells will

die in those areas as well. So in patients where the blood flow studies reveal absent (within the technical limits of the study) flow, it is reasonable to assume that all the cells (with possible exceptions to be discussed) have died. And indeed many types of blood flow studies have been done documenting inadequate blood flow to the brain in situations of brain death.

The second rationale is the data from measuring the function of the brain as a whole. The functioning brain extracts oxygen from the blood and puts carbon dioxide into the blood stream. Therefore the overall function of the brain can be determined by measuring these chemicals in the blood going in and out of the brain.

A brain dead patient can be identified by measurements of the oxygen and carbon dioxide levels in the blood going to and from the brain

In addition, the overall energy expenditure of the body can be measured, and in brain death it is decreased by the amount of energy the brain uses. Many other studies of the brain, including MRI and PET have examined the brain as a whole and documented the lack of metabolic function in the brain dead brain⁶⁰. The studies are not adequate to document the death of each and every cell⁶¹, but these studies document the irreversible cessation of metabolic function of the brain as a whole. The paragraphs below are a much more accurate depiction of the metabolic state of the brain dead patient suffering from cerebral circulatory arrest.

Without blood supply, the brain is metabolically dead; it will not receive or use oxygen, it will not generate carbon dioxide, and the supply of glucose will be depleted. Indeed, measurements of brain tissue oxygen levels are zero in brain dead patients,⁶² and every patient in whom the brain tissue oxygen level reached zero and

stayed there for more than half an hour became brain dead. The level of glucose in the brain tissue reaches near zero in 'brain dead' patients, far below the glucose level of patients who maintain function.⁶³ A 'brain dead' patient can be identified by measurements of the oxygen and carbon dioxide levels in the blood going to and from the brain. These measurements reveal that the brain is not using oxygen and is not producing carbon dioxide.⁶⁴ The cells of the body, including the brain, need to manufacture the chemical phosphorus in a particular form (ATP) in the utilization of energy. A small study using MRI scanning revealed that patients who were brain dead did not have any phosphorus in this form in their brain.⁶⁵

Cells that are alive use energy and produce heat. Normally the brain is warmer than the rest of the body, partly because of blood flow and partly because the brain is very metabolically active. The brain receives approximately 20% of the blood flow coming out of heart. The brain of the patient who is brain dead is significantly colder than the normal brain, indicating a lack of metabolic activity and blood flow.⁶⁶ Patients who are brain dead also use approximately 25% less energy (resting energy expenditure-REE) than would be predicted, again corresponding to the total cessation of metabolic activity in the brain.⁶⁷ In fact, the REE decrease correlated with worsening blood flow. As the blood flow (measured by TCD) decreased, the REE decreased, until the REE reached a nadir when the blood flow ceased.

Despite the finding of CCA, there is one area of the brain, mentioned frequently by Shabtai that sometimes retains function: the hypothalamus/pituitary area. The anatomic explanation for this possible function of the hypothalamus lies in the way blood flows to the brain and surrounding structures. There are arteries that travel into the skull but not usually to the brain, namely the external carotid arteries⁶⁸, and since these arteries travel in the linings of the brain (dura), they may be protected from the increased pressure in the

skull. Branches of the external carotid artery can supply blood to the pituitary gland. In addition, once the first branches of the internal carotid arteries enter the skull they travel to the hypothalamus and the pituitary gland. If, therefore, there is even a small amount of forward travel of the blood (when the heart pumps the blood surges forwards, when it relaxes, the blood goes back to its place, a finding described as 'to and fro flow'), it could reach just the pituitary and the hypothalamus. Because of these unique advantages regarding blood flow, function in the hypothalamus does not imply the presence of function or blood flow in any other part of the brain.⁶⁹

No patient who fulfilled clinical brain death criteria and had documented lack of flow on any of the studies has ever regained function

What is the function of the hypothalamus and how do we know it is functioning? Some of the output of the hypothalamus is *via* the pituitary gland, and so either the blood levels of those hormones can be measured or the hormonal effects on urine concentration can be measured.

The hypothalamus is also involved in temperature regulation. Shabtai repeats an erroneous assumption that a stable temperature implies a functioning hypothalamus. An elegant study showed that this is in fact not correct. The only way to be certain that the hypothalamus is actually controlling temperature is to deliberately cool the patient and measure how the body corrects itself.⁷⁰ It is theorized that there are temperature regulation control systems in the spinal cord and/or the body, outside of the brain. This is correlated by Alan Shewmon, who identified a large number of patients whose bodies were maintained for a long time after brain death. He testified that a patient who survived for many years had a stable body temperature and did not require any special temperature monitoring or support.⁷¹ At autopsy, the patient did not have a single

identifiable neuron in his brain, much less a hypothalamus.

From a physiological point of view, the hypothalamus controls temperature by secretion of a thyroid hormone and shivering. Brain dead patients usually have low levels of thyroid hormones (illustrating that this hormone is not being manipulated by the brain to control temperature), and have not been documented as shivering in response to cold. Hence the assumption that a stable temperature is a sign of a functioning hypothalamus is not accurate. Shabtai mentions that stable temperature regulation may have halakhic significance and therefore achieving precision in this discussion may be quite important.

The final point concerns blood flow, what exactly can be determined with tests, and what the tests imply. Shabtai is disturbed by reports that sometimes studies show the presence of blood flow when others show an absence of blood flow.⁷² Each blood flow study has a lower limit of accuracy, and thus blood flow can be present even if the test does not detect it. An animal model of brain death showed that even with very high ICP, a few radioactive microspheres can flow into the brain.⁷³ Therefore, the more accurate depiction is not absent flow, but inadequate flow. Inadequate flow is defined as flow that is not adequate to support the function of the target tissue. The purpose of measuring blood flow in the testing for brain death is to confirm that the finding of absent function is irreversible.

All the tests mentioned by Shabtai in fact are accurate enough to serve that function. There has not been a single patient who fulfilled clinical brain death criteria, had documented lack of flow on any of the studies, and who subsequently regained function. Shabtai's concern is misplaced. In fact it is unreasonable to expect that all blood flow tests utilizing different technologies will have the same sensitivity. As long as they accurately predict inadequate flow, they are useful.

As a result, the halakhic question becomes "What exactly is the definition of circulation?"⁷⁴ Is circulating water adequate for the presence of life? If the blood flow is infinitesimally small, but present (perhaps using a pump, rather than a heart made of tissue) is the person still alive? Is there a minimum pressure, an amount of oxygen, an amount of glucose that needs to be present in the circulation in order for it to be considered present by *halakhab*? After consideration of these questions it should be clear that while the idea of adequate flow seems to be a new concept in the discussion of blood flow to the brain, in reality it has been an unstated assumption all along when circulation has been used as a criterion for life and death. Essentially, the word 'circulation' has been assumed to mean adequate circulation. Were that not the case, then a body attached to a pump that pushes water through the body needs to be considered a living human being. Hence circulation that is not adequate to support the function of the target tissue may not fulfill the halakhic requirements to be considered circulation.

As I noted at the outset, a patient can lose all neurological function due to lack of oxygen, poisoning, infection or other process, and still maintain blood flow to the brain. Therefore some patients who fulfill criteria for brain death (based on criteria that do not require absent blood flow) will exhibit the presence of cerebral blood flow. The finding that some brain dead patients still maintain cerebral blood flow reflects the various pathologies that result in loss of brain function. From a halakhic point of view, it may be desirable or mandated for the criteria for brain death to include documentation of lack of blood flow, in which case the study needs to be done and exhibit a lack of flow.

Perhaps more important questions are, "What are the implications of absent (or inadequate) flow?" "What are the characteristics of the group of patients who exhibit no flow on

studies?” A study of 39 patients who were deeply comatose but not brain dead revealed that all but one had blood flow present on exam. The one patient without blood flow exhibited weak breathing on apnea testing, and 24 hours later fulfilled clinical criteria for brain death.⁷⁵ Another study examined blood flow in patients who were either brain dead, in a coma, or in a persistent vegetative state. Six of the patients did not fulfill clinical criteria for brain death, and significant blood flow was found in all six, despite the poor neurological condition. In 15 of the 17 brain dead patients, flow was absent.⁷⁶ Persistent lack of blood flow leads to loss of function and death of the cells affected by that lack of blood flow⁷⁷.

If the blood flow is infinitesimally small, but present, is the person still alive?

Shabtai states that it is wrong to assume that a negative perfusion scan implies that the non-functioning brain stem is irreversibly lost.⁷⁸ However there has never been a case where an adult patient who had a negative scan and who fulfilled clinical criteria for brain death has regained function. He quotes the 2008 pathology study to illustrate that less than half of the patients determined to be brain dead showed evidence of neuronal ischemia. It should now be clear how the use of the study in this context is entirely unfounded. The fact that not all the cells appeared dead by H and E staining does not imply that they are capable of returning to function, and there is very good evidence, both theoretical and clinical, that a patient who fulfills criteria for brain death and suffers from absent flow on studies will never regain any function.

The final use of the pathology report occurs on page 328 of Shabtai's book, where he states that “pathology research has shown that up to a third of patients diagnosed as ‘brain dead’ do not show any signs of moderate to severe signs of cell death in their cerebral cortices.” He then

states that “these data preclude recognizing the clinical diagnosis of ‘brain death’ as the ‘death of each and every cell of the brain’”. This again is a misuse of the study, since the cells that stain ‘not dead’ may not all be alive. He is accurate in stating that it is not possible to claim with certainty that all the cells in the brain are dead in patients who fulfill the criteria for brain death. However, if *halakhab* mandates that death is declared only when every cell in the brain is dead, standard cardiopulmonary criteria are not adequate either.⁷⁹

Moreover, a case has been reported where the autopsy failed to identify a single neuron, yet the patient's body was supported for many years after the determination of brain death.⁸⁰ By his own terms, Shabtai would have to agree that this patient was dead for many years, which illustrates that even though ‘vital motion’ persisted in the body, the person was dead. This is obviously problematic for those who maintain that ‘vital motion’ is the criterion for life.⁸¹

Dependency on summaries is a problem if it results in a failure to read the literature and understand the anatomy, physiology, blood flow and pathology of the brain

Shabtai fails to mention a number of other important points of information: He cites Shewmon's⁸² reports of patients whose bodies were supported for a long time after the determination of death, but he fails to mention that despite the prolonged support, not a single one ever regained any neurological function or the ability to breathe. He similarly fails to mention the many reports where the body was supported until the heart stopped but still there was no return of function.⁸³ He fails to mention that live brain cells are found in the brains of people who are determined to be dead via ‘usual’ criteria, even more than eight hours after death.⁸⁴ If his position mandates that a person is not dead until every brain cell is dead, this

necessitates that death should not be pronounced until at least eight hours after the heart has stopped ‘irreversibly.’⁸⁵ Shabtai expresses concern regarding inaccurate determinations of death, but fails to mention that inaccurate determinations of death occur with the use of circulatory and respiratory criteria⁸⁶.

Shabtai’s book and the RCA report before it, depend heavily on outside summaries for their discussion of the scientific aspects of brain death. This is not a problem *per se*. However, it *is* a problem if that dependence results in the failure to comb the literature, read the literature, and understand the intricacies of the anatomy, physiology, blood flow and pathology of the brain.

In response to a question posed during a recorded lecture⁸⁷ Shabtai discusses patients who are brain dead but are maintained on the ventilator for possibly an extended period of time. He states: “we don’t really have really good studies as to how long this person can continue...we don’t really know.” In fact, we do have good studies and reasonably good data on this topic. One of the studies that Shabtai cites in a slightly different context contains significant data relevant to this topic⁸⁸. In addition, a number of studies address this point specifically⁸⁹, including one considered a classic in the field that has been cited 80 times⁹⁰. Lastly, a number of experimental studies give reasonable explanations as to why the bodies of some patients can be supported after brain death and some cannot as well as the possible pathological changes that make it difficult to support these bodies over the long term⁹¹.

A book author controls the message of the book by selecting what data to include and what

not to include. Some authors, including Shabtai, also present their own interpretations of the data. Perhaps by definition, a book author presents himself as an expert on the topic of the book. An expert is someone who, through the investment of time and effort, has mastered the requisite body of knowledge, and/or has significant personal experience relevant to the topic⁹². It is reasonable to expect that an expert will present facts that are actual facts, and that the conclusions presented by an expert are reasonably supported by facts.

Some may read this appendix and want to conclude that this discussion represents a simple difference of opinion. That would be a misunderstanding. Quite simply, it is an issue of facts and what are or are not reasonable interpretations of facts. Differences of opinion can exist, but all the relevant facts need to be known and considered prior to forming opinions, and the opinions need to be supported by a reasonable interpretation of the facts. Some opinions are not supported by the facts.

Some may conclude that this presentation is overly critical. That was not the goal of this review essay. When a book is touted as “The authoritative work on the subject”⁹³ and articles state that “His skilled summation and analysis of the existing material will probably make this the book of record for some time”⁹⁴, it is necessary to clearly and unequivocally illustrate why these statements should be reconsidered.

Shabtai’s website for the book states that “All modern halakhists rely on the same medical facts.” In a matter that is literally one of life and death, we can agree that we all have a sacred obligation to ensure that those facts are stated, presented, and interpreted as accurately as is humanly possible.

NOTES

*This essay is dedicated to the memory of my father, *avi mori*, Dr. Emanuel Mordechai Stadlan a'h, who passed away during the completion of the essay. He was a man of science, learning, reason, and deep faith, an example of true *Torah u'Madda*. Even as he pursued truth and was true to his principles, his words were always gentle.

¹ Professor/Rabbi Steinberg is a pediatric neurologist and has written copiously on medicine, Halacha, and the intersection of medicine and *halakhab*, including the multi volume Encyclopedia Hilchatit Refuit. He was a consultant to the Chief Rabbinate in the 1980's when the first guidelines were established, and his involvement has continued to the present

² Rabbi Dr. David Shabtai is a fellow of the Wexner Kollel Elyon of the Rabbi Isaac Elchanan Theological Seminary at Yeshiva University. He is a graduate of NYU medical school. It is unclear from his available biographical information if he has completed internship or residency, or if he has practiced medicine.

³ Steinberg was perhaps the first to use this paradigm in the Halakhic realm in his presentation of the definition of death in his Encyclopedia. However Shabtai uses it systematically not only to present ideas, but to analyze sources and other opinions. I also employed this system in a previous publication available here: <http://text.rcarabbis.org/problems-with-defining-death-as-the-irreversible-cessation-of-circulation-what-would-we-measure-and-why-by-noam-stadlan-md/>

⁴ This approach was used in the article referenced in note 3 as well as the previous article published in Meorot.

⁵ Many early opinions (and even some current ones) contain scientific information that is demonstrably wrong. For example, R. Shmuel Vosner states that a beating heart is proof that there is some connection between it and the brain. Hearts can beat when entirely removed from the body, and donor transplanted hearts beat without any connection to the recipient brain. Some opinions interpret previous positions based on the knowledge of the day which is now known to be incorrect. How to take this information into account has very significant influence on the decisions of current *poseqim* (decisors).

⁶ Shabtai has noted that the 'consensus of *poseqim*' is against defining death by brain or respiratory criteria. While outside the scope of this review, this deserves a brief note. Who is counted in the consensus? Is one obligated to count a *poseq* whose underlying approach to the sources is entirely at odds with one's beliefs? Is a scientist obligated to count a *poseq* who discounts science? If one believes that the science of the Gemara was based only on the science of the time, does one have to take into account a *psak* based on the belief that the science of the Gemara is timeless? This question is sharpened by the discussion of the definition of death, but applies to many halakhic questions raised in the modern era.

⁷ Steinberg, "*Respiratory-Brain Death*," p.14

⁸ Ibid, p. 15

⁹ Ibid, p.15

¹⁰ Ibid, p. 39

¹¹ I discuss this in detail in the Appendix

¹² Ibid, p.130

¹³ This problem is very similar to issues raised in the secular legal realm, where the Uniform Determination of Death Act specifies death of the whole brain, while the criteria usually applied ignore EEG and hypothalamic activity. See discussion in a paper in press by the International Rabbinical Fellowship, Noam Stadlan, "Defining Death in the 21st Century-the Intersection of Science, Logic, and Halacha."

¹⁴ It can be clinically obvious if it is not functioning properly. See Appendix for an in depth discussion of the hypothalamus, its function, and the implications of its function.

¹⁵ “Halachic Issues in the Determination of Death and in Organ Transplantation” available at http://www.rabbis.org/pdfs/Halachi_%20Issues_the_Determination.pdf

¹⁶ “Controversies in the Determination of Death” available at [http://bioethics.georgetown.edu/pcbe/reports/death/Controversies%20in%20the%20Determination%20of%20Death%20for%20the%20Web%20\(2\).pdf](http://bioethics.georgetown.edu/pcbe/reports/death/Controversies%20in%20the%20Determination%20of%20Death%20for%20the%20Web%20(2).pdf)

¹⁷ The Appendix contains a detailed presentation of the actual data and an analysis of Shabtai’s statements.

¹⁸ Alan Shewmon Probably Comes The Closest To Establishing Parameters For Death Under This Construct, And Even Those Are Still Vague. See The Discussion In Reference 13 Above.

¹⁹ *Controversies in the Determination of Death: A White Paper by the President’s Council on Bioethics*, The President’s Council On Bioethics, Washington, D.C., December 2008, found at <http://bioethics.georgetown.edu/pcbe/reports/death/index.html>.

²⁰ Lizza, JP “Where’s Waldo? The ‘decapitation gambit’ and the definition of death” *Journal of Medical Ethics* 2011; 37:743-746. The paper came out in 2011 so Shabtai cannot be faulted for not including it.

²¹ Shabtai briefly touches on how this argument affects the position of Rabbi J. David Bleich, but does not identify it as a significant problem or develop the ramifications.

²² Perhaps the most cogent response to this problem has been that of neurosurgeon Peter Black who wrote: “it is simply...that without a brain, even minimal human life does not exist. The body by itself does not constitute a living person.” Black, PM. “Conceptual and Practical Issues in the Declaration of Death by Brain Criteria” *Neurosurgery Clinics of North America*. 1991. 2:2; 493-501. In other words, the difficulty in establishing exactly what about the brain makes it the vital component of human life does not negate the argument that the brain IS the vital component of human life. It should be noted that those who define life as vital motion or organized biological function have a similar difficulty in establishing an exactly what they mean.

²³ Lee, P and Grisez, G. “Total Brain Death: A Reply to Alan Shewmon,” *Bioethics*, ISSN 0269-9702 (print); 1467-8519 (online)

²⁴ See the in depth discussion by R. Alexander Tal available here: [http://www.hods.org/pdf/Nostrils,%20Navel%20or%20Heart\(1\).pdf](http://www.hods.org/pdf/Nostrils,%20Navel%20or%20Heart(1).pdf)

²⁵ unpublished paper

²⁶ Many, including Reifman and Steinberg note that the most straightforward interpretation of Rashi’s reference to ‘*libo*’ is looking for the respiratory movement of the chest

²⁷ Reichman, E “The Halachic Definition of Death in Light of Medical History” available here: <http://www.hods.org/pdf/The%20Halachic%20Definition%20of.pdf>

²⁸ Shabtai, “*Defining the Moment*” page 250

²⁹ RCA Va’ad Halacha—“Halachic issues,” p. 55

³⁰ Reifman, D “The Brain Death Debate: A Methodological Analysis” Parts I, II IIIa and IIIb *On the “Text and Texture”* website available at <http://text.rcarabbis.org/tag/daniel-reifman/>

³¹ Furthermore, if an argument from consequence is allowed to override a halakhic determination in this case, it would seem that for those *poseqim* who use it, there is precedent for an argument from consequences to override halakhic determinations in other cases.

³² Another way to salvage the circulation definition of death would be to change it to circulation that supports neurological function. It is not clear why those who are going to jettison circulation alone would automatically embrace R. Bleich’s approach

³³ Some have claimed that the definition of death cannot be based on neurological function because neurological function was not known by the rabbis of the *gemara*. This is difficult to accept for a number of reasons: the details of ‘vital motion’ were equally unknown. The decapitation and respiratory criteria can be understood as referring to neurological function. The most troubling issue is perhaps the theological one: That the Divine definition of life and death, as understood by *halakhab*, is limited by what science had been able to achieve by the close of the 5th century CE.

³⁴ R. Shabtai notes that R. Bleich (and R. Auerbach) may allow for more than one definition of death—the standard loss of circulation/vital motion, and a special circumstance of decapitation. This violates the framework of Dr. Bernat, where there is only one concept of life and death. It also is in sharp disagreement with the authors of the Va'ad Halacha report, where they state that there is only one definition of death. The logical way to combine the two accepted determinations of death is to accept that death occurs when the cessation of circulation/vital motion results in the cessation of neurological function. R. Auerbach may have been willing to accept that, given that he accepted death as the death of every cell in the brain.

³⁵ R. Yosef Carmel (email conversation) notes that there are situations where it is obvious the person is alive, and that the discussion of determining death does not apply in those situations. Therefore, the concept of respiration being the definition of life only applies in situations where the patient otherwise qualifies as dead. This does not accord with the logical construct established by Shabtai. Whether *halakbah* requires such rigid adherence to overarching logical constructs is a topic beyond the scope of this review.

³⁶ Chiong, Winston (2005). “Brain Death without Definitions,” *Hastings Center Report* 35 (6):20-30.

³⁷ It should be noted that this approach but using different content usually results in incoherent unanticipated consequences. For example, some define death as the cessation of all three of respiration, circulation and neurological function. This has the outcome of granting life to a corpse with blood flow.

³⁸ It should be clear that the only definition of death that avoids these problems is one that is based on neurological function. Then the criteria would be loss of neurological function to a certain extent, and the tests would follow. Any other concept of death, including that of vital motion, will entail some variation of the problem that Shabtai has identified. Therefore, the only halachically based definition of death that survives is that of physiological decapitation and the permutations that stem from it.

³⁹ R. Daniel Reifman has written an excellent analysis of this that is awaiting publication— showing that it is likely that his mention of circulation was simply as a test for the irreversibility of respiratory function

⁴⁰ Some have maintained that personal identity is an issue separate from the definition of life and death. Regardless of the philosophical approach, there are unavoidable practical ramifications. When the criteria for personal identity are the same as the definition of life and death, there is complete concordance of the life of the person with the identity of the person. However, if life and death is defined in one way, and personal identity is defined in another, then life and identity will not always overlap. Therefore, there will be collections of tissue who qualify as alive human beings but do not fulfill criteria to be a specific human being (perhaps a functioning body without a head), and/or there will be collections of functioning human tissue who have a personal identity, but who are defined as dead (perhaps a functioning head/brain preserved on a pump). If a definition of life and death is going to allow for the creation of these new categories, then it should also address the halakhic definitions and ramifications. This is not a problem for neurological and RBD definitions of death, but clearly is a challenge for those who define life and death as the presence of vital motion and/or circulation.

⁴¹ Steinberg, p. 109

⁴² Steinberg, p. 119

⁴³ Shabtai, p. 296, note 22

⁴⁴ Shabtai, p. 295.

⁴⁵ See website here: <http://www.israelnationalnews.com/News/News.aspx/141407> accessed 7/15/2012. This was reported by many news sources

⁴⁶ The article is available here: <http://www.haaretz.com/print-edition/news/at-90-ovadia-yosef-can-still-raise-hackles-and-politicians-hopes-1.314251> accessed 7/15/12. They attribute the change in position of R. Yosef to pressure applied by the Lithuanian yeshiva community led by R. Elyashiv.

⁴⁷ There is an unfortunate history of a paper being present as “an unfettered search for the truth” only in reality to have an agenda hidden from the reader. The document authored by Rabbi Asher Bush and

published by the RCA is a case in point. When asked why the presentation in the paper was skewed heavily against brain death, R. Bush wrote the following:

“As we got further and further into our research it became clear that the "popular" opinion was far from a simple one in Halacha, being at best one of several possibilities. Additionally, the arguments made for it in the Halachic literature tended to be weak, often based on forced readings of the rabbinic sources and in more than a few cases basic misunderstandings of biology and the workings of the human body.

So I guess you could say that much of our study was a "corrective" to show that this popular approach is not a very strong one in Halacha, not just because of "who" says it, but because of how it fits with the sources. Accordingly, we felt the need to show that this is not only the case from a Talmudic point of view, but that many of the issues are far from simple from the medical view. The fact that there are multiple points of view/disagreements in the medical literature is clear for those in that field, our goal was to show to the rabbis that this was the case”

Nowhere in the introduction or anywhere in the publicity was there any indication that R. Bush was presenting this as a ‘corrective’ or anything more than an ‘educational paper’. It was labeled as an objective presentation of the evidence. Obviously he was trying to accomplish something more than just a presentation of facts, yet this goal was hidden from the public. By hiding all the arguments supporting brain death, R. Bush denied the reader the facts necessary to come to their own conclusion.

I also asked R. Bush to correct the misrepresentation that there was no medical data supporting brain death. He responded with the following:

“With this in mind I am bothered by the fact that you call upon us to correct what you call/consider misinformation/mis-impressions we have given off. Was this same call made to Rabbi Tendler when he has done that? Was there a call for an honest accounting of the Bondi letter written by a family member after Rav Moshe was no longer capable of such rulings? Was Dr Steinberg asked to correct the misimpression given in his encyclopedia that almost all Rabbis support bsd (brainstem death-addition made by the author) and only a small few do not? If the omission of certain medical information might be considered misleading, it surely pales in comparison to what has preceded in this topic.”

Aside from the issue of ‘two wrongs make a right’, the readers of the paper had no idea of R. Bush’s position on all of the above matters. They were simply presented with a paper that was ostensibly “‘just the facts.’”

⁴⁸ For example, as noted above, some standard criteria do not require testing for electrical function on EEG. Not surprisingly, some patients determined to be brain dead retain some electrical function on EEG. If one included a negative EEG in the mandated testing for brain death, it would result in a group of patients with an absence of electrical function on EEG. So the finding of electrical function on EEG in patients determined to be brain dead can be an argument against that particular set of criteria, it isn’t a valid argument against the concept of brain death. Shabtai conflates the two.

⁴⁹ p. 32 note 28; p. 104 note 26; p. 303 note 43; and p. 328 note 26. In the first usage, he states the findings as noted but does not point out that the findings may not accurately reflect the actual life and death status of the neurons. The second citation is used to challenge Rabbi Moshe Tendler’s assertion that the brain begins to lyse 48 hours after the determination of brain death. I will not go into detail regarding the accuracy of R. Tendler’s assertion. However, in this study, 12 of the autopsies were done within 12 hours of brain death, and the other 29 were done within 36 hours. Thus this study does support Shabtai’s notation that patients are no longer being supported on the respirator for long periods after determination of brain death, but it does not support his assertion that “these results are no longer observed.” The other two instances will be discussed in the body of the paper.

⁵⁰ Wijdicks EM, Pfeifer EA “Neuropathology of brain death in the modern transplant era,” *Neurology* 70(2008): 1234-7.

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- ⁵¹Schroder R., “Later Changes in Brain Death. Signs of Partial Recirculation,” *Acta Neuropathologica*,(Berl) (1983) 62:15-23.
- ⁵² Zille M, Farr, TD, Przesdzing, I, et al. “Visualizing cell death in experimental focal cerebral ischemia: promises, problems, and perspectives” *Journal of Cerebral Blood Flow & Metabolism* (2011), 1–19.
- ⁵³ Saposnik G, Munoz DG. “Dissecting brain death: Time for a new look, *Neurology* 70(2008): 1230-1.
- ⁵⁴ see reference 4
- ⁵⁵ Wijdicks EM, Pfeifer EA “Neuropathology of brain death in the modern transplant era”. *Neurology* 70(2008): 1234-7.
- ⁵⁶ The first definition of this word (dictionary.com) is “to present, especially deliberately, the appearance of being; profess or claim, often falsely: *a document purporting to be official.*”
- ⁵⁷Figaji, AA, Kent SJ, “Brain Tissue Oxygenation in Children Diagnosed With Brain Death” *Neurocrit Care* (2010), 12:56–61.
- ⁵⁸ The arteries carry oxygenated blood to the brain. The functioning brain extracts oxygen, and the blood in the veins carries away the carbon dioxide that the functioning brain produces. Therefore, the oxygen content of the blood in the veins is significantly lower than the oxygen content of the blood in the arteries. Similarly the carbon dioxide content of the veins is higher than the carbon dioxide content of the arteries. If the brain is not functioning-i.e. brain death, the brain does not extract oxygen from the arterial blood. The oxygen rich blood flows untouched to the veins. One indication of absent function therefore is high oxygen content of venous blood. In fact, measurements of high oxygen content of blood in the jugular vein correlate very well with brain death. See for example: Díaz-Regañón G, Miñambres E, Holanda M et al “Usefulness of venous oxygen saturation in the jugular bulb for the diagnosis of brain death: report of 118 patients” *Intensive Care Medicine* (2002) 28:1724–1728
- ⁵⁹ Van Santbrink H, Maas A, Avezaat C, “Continuous Monitoring of Partial Pressure of Brain Tissue Oxygen in Patients with Severe Head Injury” *Neurosurgery* (1996)38:1. 21-31
- ⁶⁰ See for example: Selcuk H, Albayram S, Tureci E et al. “Diffusion-weighted imaging findings in brain death” *Neuroradiology* (2012) 54:547–554. Also Meyer MA. "Evaluating brain death with positron emission tomography: case report on dynamic imaging of 18F-fluorodeoxyglucose activity after intravenous bolus injection." *Journal of Neuroimaging*. (1996) 6(2):117-9.
- ⁶¹ See discussion at the end of this Appendix regarding the survival of individual brain cells
- ⁶² S Palmer, MK Bader, “Brain tissue oxygenation in brain death,” *Neurocritical Care* 2:1 (2005) 17-22. None of the patients with oxygen levels above zero became brain dead. Jack Rose, Terry Neill et al, “Continuous monitoring of the microcirculation in neurocritical care: an update on brain tissue oxygenation,” *Current Opinion in Critical Care* 12 (2006) 97-102.
- ⁶³ AB Valadka, JC Goodman, et al “Comparison of brain tissue oxygen tension to micro dialysis-based measures of cerebral ischemia in fatally head-injured humans,” *Journal of Neurotrauma* 15:7 (1998) 509-19. See also MK Schultz, LP Wang et al “Cerebral microdialysis monitoring: determination of normal and ischemic cerebral metabolisms in patients with aneurismal subarachnoid hemorrhage,” *Journal of Neurosurgery* 93:5 (2000) 808-14. Also N Stahl, P Møllergaard et al, “Intracerebral Microdialysis and bedside biochemical analysis in patients with fatal traumatic brain lesions” *Acta Anaesthesiologica Scandinavica* 45 (2001) 977-985.
- ⁶⁴ Nino Stocchetti, Elisa Zanier et al “Oxygen and Carbon Dioxide in the cerebral circulation during progression to brain death,” *Anesthesiology* 103 (2005) 957-61.
- ⁶⁵ F. Aichner, S. Felber et al, “Magnetic resonance: a noninvasive approach to metabolism, circulation and morphology in human brain death,” *Annals of Neurology* 32:4 (1992) 507-11.
- ⁶⁶ Christopher Rumana, Shankar Gopinath et al, “Brain temperature exceeds systemic temperature in head-injured patients” *Neurologic Critical Care* 26:3 (1998) 562-567.
- ⁶⁷ M. Bitzani, D Matamis, et al “Resting energy expenditure in brain death,” *Intensive Care Medicine* 25 (1999) 970-976.

⁶⁸ The arteries that enter the skull and supply blood to the brain are the internal carotid arteries and the vertebral arteries

⁶⁹ The internal carotid arteries are paired (one on each side). The vertebrobasilar system supplies blood to the posterior part of the brain and the brain stem. The vertebral arteries enter the cranial vault by crossing an edge of bone at the foramen magnum. This is the only opening of any size in the cranium, and with high ICP, the swollen brain frequently herniates out. Therefore, the vertebral arteries would be compressed on either side of a bony ridge, making the cessation of flow much more definitive than the internal carotid artery. In addition, the brainstem contains many closely packed nuclei that have function. If the brainstem received any significant amount of blood flow, it is reasonable to expect that some function or reflex would be clinically found. The lack of clinical brainstem function is further proof of the lack of brainstem blood flow.

⁷⁰ Behr R, Ehrlenspiel D, Christophis P. "Temperature Regulation As possible prognostic indicator with Acute Intracranial Lesions" *Acta Neurochir (Wien)*(1996) 138:192-199

⁷¹ Available here: <http://bioethics.georgetown.edu/pcbe/transcripts/nov07/session5.html>
the autopsy report was published as well: Repertinger, S, Fitzgibbons WP, Omojola MF, Brumback RA "Long Survival Following Bacterial Meningitis-Associated Brain Destruction" *Journal of Child Neurology* (2006);21:591–595; DOI 10.2310/7010.2006.00137

⁷² page 305

⁷³ Karlis P, Sedigh A, Molnar C, Janssen L, et al "Standardized experimental brain death model for studies of intracranial dynamics, organ preservation, and organ transplantation in the pig," *Critical Care Medicine* (2011) 39:512–517

⁷⁴ Please see the extensive discussion on this topic here: <http://text.rcarabbis.org/problems-with-defining-death-as-the-irreversible-cessation-of-circulation-what-would-we-measure-and-why-by-noam-stadlan-md/> accessed 6/21/11

⁷⁵ Dosemeci L, Babur D, Yilmaz M, Cengiz M, et al "Utility of Transcranial Doppler ultrasonography for confirmatory diagnosis of brain death: two sides of the coin". *Transplantation* (2004) 77:1:71-75.

⁷⁶ Schlake HP, Bottger IG, Grotemeyer KH et al "Determination of cerebral perfusion by means of planar brain scintigraphy and ^{99m}Tc-HMPAO in brain death, persistent vegetative state, and severe coma" *Intensive Care Medicine* (1992) 18:2:76-81.

⁷⁷ As noted above, parts of the hypothalamus may be protected in some cases from the lack of blood flow, but there is no reason to believe that this applies to any other part of the brain. Obviously rare cases of abnormal vasculature can occur, but those would be extraordinarily uncommon. As noted above, the brainstem contains many closely packed functioning nuclei, and if the cells of the brainstem were viable in a significant number, there would be observable brainstem function manifested by reflexes, breathing, or other clinically observable function. While final edits were being done on this paper, an additional case was reported where a patient demonstrated lack of flow on testing, but retained breathing and some movement. Budohoski KP, Aries MJ, Kirkpatrick PJ, Lavinio A. "Protracted cerebral circulatory arrest and cortical electrical silence coexisting with preserved respiratory drive and flexor motor response" *British Journal of Anaesthesia* (2012) 109(2):293-4.

Obviously this patient did not fulfill criteria for brain death due to the continued breathing and movement. The implications of this paper and related blood flow issues are the topic of a presentation that has been accepted for the upcoming meeting of the American Association of Neurological Surgeons (spring 2013).

⁷⁸ p. 303

⁷⁹ See discussion below.

⁸⁰ Repertinger, S, Fitzgibbons WP, Omojola MF, Brumback RA "Long Survival Following Bacterial Meningitis-Associated Brain Destruction," *Journal of Child Neurology* (2006);21:591–595; DOI 10.2310/7010.2006.00137

⁸¹ Shabtai addresses this point in the book and states that it is possible for R. Bleich to assert that there are in fact two different concepts of death- death of every neuron and cessation of ‘vital motion’. This however would contradict the authors of the RCA document who state early on that there is only one concept of life and death. In addition, it raises further questions as to which concept is controlling when the patient fulfills one concept for death but not the second.

⁸² Shewmon, DA “Chronic brain death- a meta analysis and conceptual consequences”. *Neurology* (1998). 51: 1538

⁸³ Jennett B, Gleave J, Wilson P. “Brain death in three neurosurgical units” *British Medical Journal*(1981) 282(6263):533-9.

⁸⁴ Verwer RW, Hermens WT, Dijkhuizen P, et al.” Cells in human postmortem Brain tissue slices remain alive for several weeks in culture.” *FASEB Journal* (2002). 16: 54–60

⁸⁵ It actually never irreversibly stops, as R/D Shabtai acknowledges. One can always attach a pumping machine to provide circulation.

⁸⁶ Adhyanan V, Adhyanan S, Sundaram R “The Lazarus phenomenon”. *Journal of the Royal Society of Medicine* (2007) 100(12):552-7.

⁸⁷ November 2010 available at:

<http://www.torahcentral.com/YUTorah/lecture.php?752286/Rabbi%20Ezra%20Labaton/Defining%20The%20Moment:%20What%20Does%20It%20Mean%20To%20Be%20Dead?>

⁸⁸ Shewmon DA: Chronic “brain death”: Meta-analysis and conceptual consequences. *Neurology* 1998;51:1538–1545. See my discussion of this paper above.

⁸⁹ Al-Shammri S, Nelson RF, Madavan, R et al “Survival of cardiac function after brain death in patients in Kuwait” *European Neurology* (2003) 49(2): 90-3.

Hung TP, Chen ST “Prognosis of deeply comatose patients on ventilators” *Journal of Neurology Neurosurgery and Psychiatry* (1995). 58(1): 75-80. and Al-Attar B, Shaheen F, Salam MA, Al-Sayyari A, Babiker A, Zakaria H, Babiker A, Saclayan L.

“Implications of ICU stay after brain death: the Saudi experience,” *Experimental and Clinical Transplantation*(2006) 4(2):498-502.

⁹⁰ see reference 86 above.

⁹¹ for example, see: Shivalkar B, van Loon J, Wieland W, et al. “Variable effects of explosive or gradual increase of intracranial pressure on myocardial structure and function.” *Circulation* (1993) 87:230–9.

⁹² I certainly do not claim that one has to be a specialist in the neurological sciences to be an expert on this topic. In fact many of my neurology and neurosurgical colleagues, despite an excellent knowledge of how to apply the criteria, would not consider themselves an expert on this topic. Similarly, completing medical school is not a guarantee of mastery of the topic. see here: Tawil I, Gonzales SM, Marinaro J et al, “Do Medical Students Understand Brain Death? A Survey Study” *Journal of Surgical Education*(2012) 69(3): 320-325

⁹³ http://www.ou.org/jewish_action/11/2012/defining-the-moment-understanding-brain-death-in-halakhah/

⁹⁴ <http://www.jewishideasdaily.com/4987/features/the-brain-death-wars/>