Clamping umbilical cord: Shutterstock

Stem Cell Research and Judaism: Ethical Concerns

By Jonathan Crane

Introduction

The potential of stem cell research to contribute to human understanding of human development, aging, ailment, and demise is indisputable. Specifically, stem cell research can enable scientists to investigate the processes of many debilitating and lethal diseases, including cancers and other DNA mutations. This line of research can also promote the development and testing of pharmaceutical treatment regimens without harming human beings as such. And it can lead to the creation of new cells, tissues, and even organs, for homogenous transplantation, which would require far less exhausting and expensive immunosuppressing interventions than the more common xenotransplantation practice currently in vogue. Such scientific and medical advancements are indeed exciting and merit investment. But we should be precise. The stem cells most useful for such advancements are pluripotent stem cells. So the question at hand is where to source pluripotent stem cells.

Current research identifies three sources for pluripotent stem cells: adult cells, umbilical cells, and embryonic cells. Adult cells are somatic cells taken from a body after it has been born and they are highly specialized: there are

hundreds of different kinds of cells in the human body. With effort, adult cells can be retrograded back to a stage in which they are multipotent, that is, to a stage in which they can further specialize, albeit not to every other kind of cell in the body. Recent studies have been able to induce adult stem cells back further to a pluripotent stage.[1] While promising, many challenges—technological as well as biological—complicate this line of research and limit its viability as an inexhaustible source for pluripotent stem cells.

Blood extracted from umbilical cords shortly after birth is another promising source for pluripotent stem cells.[2] Gaining unfettered access to such cells may pose a difficulty, however. And the pluripotency of such cells has yet to be demonstrated. Perhaps the most promising sources of pluripotent stem cells are those derived from embryos.[3] Not all stages of fetal development house pluripotent stem cells, however. In the first few days after conception, the cells are totipotent: they can become any cell necessary to enable the embryo to develop. Division of cells continues until they create a ball of perhaps 140 cells that are all totipotent. After this blastocyst stage, however, the cells become somewhat specialized. During gastrulation, the outermost layer of cells eventually becomes the placenta and other material necessary to house the developing fetus. The inner cells—the embryoblast—are the source of pluripotent embryonic stem cells, since they eventually give rise to the multipotent cells that further specialize into the numerous structures comprising the human body. Such cells exist only early on in fetal development: they can be found only up to approximately 20 days after conception. Even with technological advancements, extracting these pluripotent embryonic stem cells destroys the integrity of the blastocyst as well as the embryoblast itself. For this reason, concerns about embryonic stem cells overlap with those regarding abortion.

This essay surveys Judaic perspectives on these promising yet imperfect ways of securing pluripotent stem cells for scientific and medicinal purposes. As one might expect, there is disagreement among modern Jewish bioethicists about which modes of securing these cells is permissible. Yet there is overwhelming consensus among them that using such cells to improve scientific knowledge and medicinal treatments is indeed permissible if not obligatory. To appreciate these dynamics, we first look at some principles Judaism holds in regard to medicine in

general. We then investigate in light of Judaic texts the particular strategies used to extract and establish pluripotent stem cells. The concluding section evaluates these principles and concerns.

Jewish Principles Regarding Medicine

First and foremost, Judaism assumes human life to be sacred in and of itself. This is due in part to the presumption that God is the ultimate owner of human bodies and humans are but tenants given the responsibility to care for their fleshy domains.[4] This does not mean, however, that humans may not take any risks or exercise certain freedoms; indeed they may and should—within limits, of course.

Insofar as stewardship of our bodies is part and parcel of what it means to be human, developing strategies and techniques to care for those bodies is thus obligatory. This responsibility complements the understanding that God is a healer if not the ultimate healer and that humans nonetheless function as God's partners and agents in healing processes. As human agency is necessary to actualize human health, the next question is to what end: what goal or goals should human healing efforts pursue? Building on biblical texts, the rabbis articulate that at base humans are duty bound to do what is necessary for returning the ill to wellbeing and for preserving health.[5]

The charge to preserve life thus becomes the basis for most if not all Jewish medical practices. This is encapsulated in the phrase *pikuach nefesh*, which literally means to 'open a life' since the Talmudic reference speaks of uncovering someone trapped in the rubble of a collapsed building.[6] It is unclear, however, precisely what constitutes existential danger that would trigger the mandate of *pikuach nefesh*. Must the beneficiary of human intervention be a specific person, or could it be an abstract one, like *someone* suffering a particular lethal (or morbid) condition? And how much injury or pain must one suffer before one qualifies for this kind of attention? And who is obliged to offer medicinal intervention? Could a hypothetical future person suffering debilitating genetic disease be a sufficient cause to motivate action today—like stem cell research? The rabbis answer many of these and related questions by ruling that health measures must be taken even on Shabbat. That is, health trumps religious strictures. Exceptions exist, though. If one is being forced to murder another human, or if one is tyrannized to practice idolatry, or if one is coerced to

engage in illicit sexual relations—these are causes to forfeit one's life.[7] And we should remember that biblical and even rabbinic Judaism countenanced capital punishment, which means that at least in principle some human life may be forfeited if not destroyed.[8] So though the presumption that human life is sacred, not all human life must be preserved in every instance.

Related to this exception regarding the undesired yet permissible termination of life is moral stature at the beginning of life. Full moral status, replete with all the responsibilities and protections afforded to adults, accrues in stages; it is not given the moment an ovum is fertilized. Rather, moral significance intensifies not with fetal development per se but with time (more will be said about this below). Emergence from the birth canal affords the newborn significant moral stature but not the same as is given to adults. Only through time and with physical development does a young baby and child gather moral stature. To illustrate, a post-partum baby is unnamed until the 8th day when it is ceremonially welcomed into the Jewish community. Were a baby to die within its first month, no *Shiva* or week of mourning is performed nor the regular recitation of the *Kaddish* prayer during the next year. A child is not culpable for his or her actions as would be an adult until that child begins to manifest evidence of puberty; this is recognized through *bar/bat mitzvah* ceremonies in which a young person is welcomed as a full-fledged adult member of the community, morally and legally responsible for his or her actions. That moral stature grows and intensifies through time obviously has implications for our discussion here of stem cells, especially those extracted from embryos.

Sources of Stem Cells

Jewish attitudes toward the development of pluripotent stem cells varies regarding on the source of those cells. Suppose blood taken from an adult (anyone post-partum) could serve as a source of cells adequate for inducement to pluripotency; the question would arise whether bloodletting itself is permissible. Indeed it is—for both therapeutic and preventive measures.[9] Moreover, it is permissible for an adult to give blood as frequently as once per month.[10] Thus it would seem that stem cells derived from adult somatic cells engenders no resistance. Research along these lines can and perhaps should be pursued.

Things become a bit more complicated when using blood

taken from umbilical cords. At least in Ezekiel's time, it may not have been customary to cut the umbilical cord at all (Ezekiel 16:4). This throws into question how a newborn finally gains separation from the placenta. Be that as it may, the rabbis of the Talmud rule that umbilical cords must be cut when twins are born lest one become lethally entangled in them.[11] They also extend this rule even to singletons: "the umbilicus must be tied, the placenta cut and hidden, so that the [single] newborn may be kept warm."[12] It is unclear what keeping a newborn baby warm actually means. Does it mean that the baby should receive all the blood in the umbilicus before it is severed? Or does it mean that the umbilicus should be cut and removed quickly so the child can be covered or held closely by the mother or other adult? If the former, this teaching might curtail Judaic permission of extracting umbilical blood for ulterior purposes. The latter, obviously, does not hamper this strategy.

In relation to this the rabbis contemplate the scenario of a child born in the eighth month after conception.[13] They rule that the Sabbath may not be desecrated by cutting its umbilical cord. This does not apply for a child born only after seven months of gestation, however. For this premature birth, the umbilical cord is to be cut and the placenta buried so the child can be kept warm—that is, Shabbat may be desecrated for this child. If it is uncertain whether the newborn emerges in its seventh or eighth month, the assumption is to be conservative (that is, religiously, not biologically) and not profane the Sabbath by cutting its umbilicus. This does not mean that children born after 8 months of gestation (or thereabouts) never have their umbilical cords cut; rather, it means that theirs are severed only after the conclusion of the Sabbath in which they were born. Certainly, we can assume that by that time all the blood that had been in the umbilical cord would have drained into the newborn. Though this ruling stipulates when umbilical cords may (not) be cut for a newborn, in many situations it precludes the possibility (and hence the permissibility) of extracting umbilical cord blood for ulterior purposes.[14]

The most controversial sources—as well as the most promising sources—of pluripotent stem cells are those that come from embryos. Not all embryos are alike, to be sure. It should be acknowledged that 30-50% of all fertilized eggs do not implant, and that near 20% of known pregnancies

spontaneously miscarry within the first 20 weeks of gestation. This means that perhaps as many as 60% of all fertilized eggs never reach viability (~26 weeks, though even this would entail significant neurological complications). The question thus arises whether using pluripotent stem cells from those naturally aborted embryos is permissible. A further question is whether embryos purposefully aborted may be similarly permissible. A third question regards those embryos—zygotes, to be precise—that otherwise would be implanted during in vitro fertilization procedures but are no longer needed or desired by the intended parents: would using them for stem cells be permissible? A fourth concern regards the intentional creation of zygotes for the sole purpose of extracting stem cells; their creation is never meant for reproduction per se. All four sources—naturally discarded, purposefully aborted, supernumerary IVF zygotes, and lab-created zygotes—are all viable sources: pluripotent stem cells *can* be derived from them. And all are relatively abundant.[15] So our question is not *if* but *may* any of these be sources for pluripotent stem cells.

In regard to spontaneously aborted embryos, we must determine its moral status before we can decide whether they may serve as sources for the stem cells we seek. The classical rabbinic source on this subject is the Talmud in which the rabbis discuss whether a woman married to a priest may consume a particular kind of sacrifice that she could avail herself of were she not pregnant. Rabbi Hisda teaches that a woman may eat this sacrifice up to the 40th day of gestation, because up to that point the embryo is considered only water (*maya b'alma hee*).[16] The medieval sage, Rabbi Shlomo ben Yitzhak (also known as Rashi), clarifies that it is only on (or after) the 40th day that the embryo becomes formed.[17] The early rabbis rule that when a woman miscarries within the first 40 days of gestation she is not required to perform the usual cleansing rituals for a later miscarriage or formal birth.[18] Again, this is because it is assumed that an embryo younger than 40 days has not achieved sufficient physical formation to merit even minimal moral status.

After the 40th day its status changes, but it does not acquire the same status as an independent adult or even a born child, however. Rather, it is assumed that the embryo is a part of the mother.[19] Certainly this will have implications for induced abortions—as will be discussed momentarily. In regard

to spontaneous abortions, it means that what emerges from the mother should be treated as if it had been a part of the mother, like her thigh, as the Talmud says.[20] That is, a second-trimester embryo naturally miscarried should be viewed as more morally valuable than mere fluid but less than a full human.[21] These and other texts reflect an enduring Jewish worldview that moral status of humans accrues through time and not at the supposed instant of conception (which science has proven takes time, perforce challenging those theologies claiming otherwise and that ensoulment happens in that particular moment).[22] We can therefore surmise there are no legal or moral barriers to deriving scientific and medical benefit from the pluripotent stem cells derived from spontaneously aborted embryos.

Intentionally aborted embryos, on the other hand, pose a more significant legal and moral challenge. Jewish deliberation about therapeutic abortion begins with a biblical text found in the chapter immediately following the promulgation of the 10 Commandments, a textual location suggesting its relative import.

When men fight, and one of them pushes a pregnant woman and a miscarriage results, but no other damage ensues, the one responsible shall be fined according as the woman's husband may extract from him, the payment to be based on reckoning. But if other damage ensues, the penalty shall be life for life….[23] This classic text reinforces the position that an embryo is *not* valued morally or legally the same as an independent human being; monetary compensation is suitable for the loss incurred.[24] Some might argue that this holds only if the loss of the embryo was not the primary goal but an unintended consequence. The rabbis disagree: for them, the principle holds even for those scenarios of intentionally causing a miscarriage. For example, if an embryo's existence or emergence endangers the mother, it is to be dismembered and removed.[25] This is no crime, and no compensation to the husband is necessary. This became the rule in the medieval period when Moses Maimonides codified it: "when a woman has [life threatening] difficulty giving birth, one may dismember the embryo in her womb—either by drugs or by surgery—because [the embryo] is like a pursuer seeking to kill [the mother]."[26] This ruling echoes the position taken by the Talmudic rabbis that no delay is required for a pregnant woman scheduled to die for a capital crime; the embryo is to die with

her. Indeed, the court instructs that it would be best for the embryo to be killed prior to her execution lest she be disgraced by its bloody natural expulsion after her death.[27] Though it is obvious in these latter texts that the concern is the speedy execution of justice, they nonetheless reinforce the overarching attitude that an embryo not yet in the process of being born has no legal or moral standing that prevents or complicates judgment and punishment against the adult woman in whose womb it resides. It is not a human life as such. This attitude is highlighted by the ruling that once the embryo's head breaches the birth canal, no such lethal interventions may be taken against it.[28]

Contemporary scholars continue the debate about the permissibility of inducing abortions. While there are too many scholars to survey here, suffice it to say that the vast majority permits and even requires abortion when the mother's life is at risk. Many also permit second-term abortions in the case of genetic diseases, rape, or medically-caused malformations like thalidomide. Even though a select few hold the position that all abortions are prohibited, and at the other extreme some contend that nearly any reason is sufficient warrant for an abortion—most Jewish scholars and clergy maintain that abortion is a lamentable yet permitted procedure in certain circumstances, and that no legal punishment or moral condemnation should be imposed. So, like naturally occurring miscarriages, we can conclude that extracting stem cells from intentionally aborted embryos would be permissible.

The third source—super-numerary IVF zygotes—raises fewer concerns. Insofar as frozen zygotes cannot become human beings in either their current frozen state or thawed in a petri dish but only if and when they become implanted within a human womb, there is no question of their moral status: *at most* they can be considered "merely water."[29] If zygotes less than 40 days old within the womb have no moral or legal status, then all the more so would zygotes ex utero. Certainly it would be ideal for these otherwise unwanted zygotes to be given over to couples and individuals who cannot conceive on their own. Insofar as this does not happen, these zygotes may be and are discarded. Though there may be no legal or moral reason preventing them serving as sources for pluripotent stem cells, concern arises to their utilization for such purposes because it requires rendering otherwise

healthy zygotes inanimate. So we question whether government monies should be used to kill that which is currently healthy to help at some future point those who are unhealthy.

Finally, what about creating zygotes for the sole purpose of destroying them in the extraction of their pluripotent stem cells? Problems arise not in regard to the zygotes (as seen in the preceding paragraph) but to their very creation. On the one hand men are discouraged (some say prohibited) from ejaculating if not for the purpose of procreation.[30] This concern can be met by claiming that such efforts are to assist advancing scientific knowledge and medical healing powers. On the other hand, extracting eggs requires women to take drugs to stimulate hyperovulation, and evidence exists that this may increase risks for various kinds of cancer and other health problems.[31] These real risks to the individuals involved may outweigh the possible collective benefits derived from extracting those eggs, constructing zygotes, and removing their pluripotent stem cells.

Ethical Calculus

There are several ways to weigh ethical concerns regarding the pursuit of stem cell research. Consequential arguments usually try to balance the purported benefits of stem cell research against the risks entailed in extracting them. As noted at the outset, regardless of how the cells are procured, the benefits of such research are the same, including improved knowledge of cellular development and DNA functioning, ex vivo drug experimentation, and construction of homogeneous fluids, tissues, structures, and organs. The risks, however, differ according to the potential source.

Consider. Using adult cells as the source for pluripotent stem cells entails few risks, and fewer still that would have such moral suasion as to curb this line of research. The major concerns here are the relative cost of overcoming the technical challenges (as compared to the cost of deriving cell lines from other sources) and the biological limitations these cells pose. The first is a logistical challenge and can be met and/or justified. The latter may prove to be insurmountable, but only further research can tell.

Umbilical stem cells, by contrast, are more difficult to source than adult cells, but their potential to offer biologically sound pluripotent stem cells is far superior. This does not mean that every umbilicus should be considered a non-

question-begging source for cells. In some circumstances the Judaic tradition mandates that a cord remain attached to a newborn until cutting may be done without profaning the Sabbath, depending on the gestation age of the newborn. This means the *immediate and real* wellbeing of this particular person trumps the *future and potential* wellbeing of uncertain others.

Scientifically the most promising source for pluripotent stem cells are those derived from embryos. In regard to spontaneously aborted embryos and especially those younger than 40 days, there are hardly any barriers to their serving as a source. Nevertheless, there are practical challenges to gathering these embryos hygienically, as most if not all are expelled in settings beyond the clinic and lab. This thus adds pressure to gain access to those embryos that are expelled in hygienic settings, that is, to those that are intentionally aborted. While there is general Jewish support permitting abortion in certain circumstances, the permissibility of using aborted embryos as sources of pluripotent stem cells should not serve as a reason in and of itself for any abortion. The potential generic benefit intimated by stem cell research is no warrant for the termination of any specific pregnancy. This thus inverts the calculus we saw regarding umbilical stem cells: the future and potential wellbeing of uncertain others does not trump the immediate and real wellbeing of this particular embryo. Though, of course, when there are other compelling reasons justifying a particular abortion, use of those embryonic stem cells may be permitted.

One might think the use of ex utero zygotes pits the obligation to procreate against the obligation to heal.[32] But there is a significant difference between those that are frozen for IVF purposes from those that are created for the sole purpose of being destroyed en route to providing stem cells. The only difference pertains to their original purpose. Supernumerary zygotes were intended to fulfill procreative purposes, but now that they are no longer needed or wanted they are, biologically, no different than those created for the sole purpose of being sources of stem cells. So where is the issue of harm here? It comes back to the very process of pharmacologically stimulating a woman to hyperovulate and the risks involved in taking those drugs and hormones. Thus the ethical challenge here is between the real risks to these particular women and the possible benefit

to unknown future others. Insofar as modern Jewish bioethicists generally endorse the limited use of hormones to stimulate hyperovulation for procreative purposes for those women for whom it makes sense, it would only be consistent that that same level of exposure to risk be extended to women to hyperovulate for the purpose of creating zygotes for healing others. To be sure, this does not mean all pre-menopausal women can or should take hormones to hyperovulate for the purpose of creating zygotes. Rather, it means that if a woman chooses to contribute her DNA to this project, she may—because persons may take on certain (but not unreasonable or unlimited) levels of individual risk for the welfare of unknown others. This assumes, of course, that women not wanting to have children are willing to avail themselves to these kinds of risks. Perhaps a sharper question refers to those frozen eggs already taken from women for procreative purposes that have yet to be fertilized: may they be used for a different purpose, that is, may they be used to create zygotes for stem cells? In this situation—which is perhaps more realistic than imagining a population of women vying to give their DNA only for research—the dangers of hyperstimulation are no longer an issue since the eggs are already ex utero. The issue thus seems to be not one of harm but one of consent: whether a woman consents to have her DNA used for research instead of procreation.[33]

The aforementioned ways of thinking demonstrate consequential reasoning; they demonstrate a powerful way of calculating what to do by taking harms and benefits into consideration. But it is not the only way, nor the only Jewish way, of thinking through morally fraught possibilities. Another way of reasoning is more deontological, looking to overarching duties, rules, or principles that should guide our decision-making. For example, some bioethicists point to the theological claim that human beings are created in the image of God. This claim is considered sufficient warrant to conclude that no matter how "prehuman" an entity may seem "we certainly are not obligated or even permitted to kill an embryo for the more indirect benefit of the advancement of possibly helpful scientific information."[34] Though this may seem like a consequential argument, it is not. It is a form of Kant's categoricalism: humans (and their DNA) may not be treated as means to an end, but only as ends in and of themselves. One question to levy against this line of

reasoning is why that foundational claim (e.g. *imago dei*) should constrain or frame our thinking instead of (or more than) another foundational claim (e.g. *pikuach nefesh*). For example, it could very easily be reasoned that the duty to heal (including all the research healing requires) should trump the idea that all humans are made in God's image. To address this conundrum, even more abstract or meta-ethical values would need to be identified to help us discern which of these foundational claims should lead our calculus.

From the outset it is reasonable to say that the Judaic textual tradition can endorse research using pluripotent human stem cells. Things get complicated when we consider how best to source those stem cells. The least non-question-begging source of stem cells, besides adult ones, would be those extracted from supernumerary zygotes, as they have already been created and have no further utility. Contributing to the benefit of future unknown people should be considered a sufficient good, at least in this regard.

Notes

[1] Kazutoshi Takahashi, Shinya Yamanaka, 2006, 'Induction of Pluripotent Stem Cells from Mouse Embryonic and Adult Fibroblast Cultures by Defined Factors.' *Cell*, 126, 4, pp. 663-676; Yu J., Vodyanik M.A., Smuga-Otto K., Antosiewicz-Bourget J., Frane J.L., Tian S., Nie J., Jonsdottir G.A., Ruotti V., Stewart R., Slukvin II, Thomson J.A., 2007, 'Induced pluripotent stem cell lines derived from human somatic cells.' *Science*, 318, 5858: pp.1917-20.

[2] Greish S., Abogresha N., Abdel-Hady Z., Zakaria E., Ghaly M., Hefny M., 2012, 'Human umbilical cord mesenchymal stem cells as treatment of adjuvant rheumatoid arthritis in a rat model.', *World J Stem Cells*, 4, 10: pp.101-9. doi: 10.4252/wjsc.v4.i10.101; Ratajczak M.Z., Machalinski B., Wojakowski W., Ratajczak J., and Kucia M., 2007, 'A hypothesis for an embryonic origin of pluripotent Oct-4+ stem cells in adult bone marrow and other tissues.' Leukemia, 21, pp. 860–867, doi:10.1038/sj.leu.2404630.

[3] See, for example, Vazin T., Freed W.J., 2010, 'Human embryonic stem cells: derivation, culture, and differentiation: a review.' *Restorative neurology and neuroscience*, 28,4: pp. 589-603.

[4] See Exodus 19:5; Deuteronomy 10:14; Psalms 24:1. There are significant philosophical and theological problems to the argument that humans are sacred because they are *betzelem elohim*, created in God's image (Genesis 1:28). Not only is this claim scant in the bible (mentioned only again at Genesis 5:1 and 9:6), it is unclear (a) what *tzelem* means (it can mean shadow, idol, or image); (b) what the precise physical features of the original are (i.e., God; this is problematic since God is presumed not to have a physique); and (c) where the precise boundaries of God's image actually exist (e.g., if cognition is taken to be a quintessential feature of God and thus of humans, science demonstrates that some animal species share many of these cognitive capacities; consistency would mandate appreciating those animals as also "images of God").

[5] Deuteronomy 22:2; Exodus 21:19; Leviticus 19:16; Leviticus 18:5; BT *Bava Kamma* 85a; BT *Sanhedrin* 73a; BT *Yoma* 84b-85a.
[6] BT *Yoma* 84b. Some might look to these biblical texts to ground the claim that all interventions may be done to save a life: Leviticus 18:5; Ezekiel 20:11, 13 and 33:15; Nehemiah 9:29; Deuteronomy 4:1.
[7] See discussion embedded within BT *Sanhedrin* 72-74.
[8] For but one example, see M *Sanhedrin* 4.5.
[9] See Julius Preuss, 1993 [1911], *Biblical and Talmudic Medicine*, 248-256. Originally published in German, Fred Rosner (trans.), Northvale: Jason Aronson Press.
[10] BT *Shabbat* 129b.
[11] Ibid.
[12] Ibid.
[13] *Bamidbar Rabbah* 4.3; *Midrash Tanhuma, Bamidbar* 9b. They make this ruling based on BT *Shabbat* 135b (which speaks of circumcising a premature boy on its 8th day post-partum) and *Tosefta Shabbat* 16.
[14] We should note that these practices were codified no later than medieval Jewish law. SA *Orach Chayim* 330.7.
[15] Estimates put the number of supernumerary frozen zygotes in fertilization clinics in the United States alone between 200,000-400,000. Naturally discarded embryos, of course, will exist as long as humans reproduce. And no matter how hard authorities struggle to regulate or outlaw abortion, it has been a feature of nearly every civilization from time immemorial. Lab-created zygotes is technically feasible; the procedure merely awaits legal protection and funding.
[16] BT *Yevamot* 69b.
[17] Rashi, BT Yevamot 69b, s.v., tovelet. Elsewhere, the Talmud and Rashi assert that a female embryo becomes formed after the 40th day, perhaps as late as the 80th day. See BT *Niddah* 30b; Rashi, BT *Niddah* 30b, s.v., *v'dilma ee karveha*, and *b'simaneihon shavin*; Tosefta, *Niddah*, 4.17. These texts portray a rather gruesome experiment done by Queen Cleopatra who forced pregnant female prisoners to drink an abortifacient concoction so as to observe the development of their embryos.
[18] M *Niddah* 3.7. See also Rashi, BT *Niddah* 30a, s.v., *ainah chosheshet le-valad*.
[19] BT *Arachin* 7a. There, it is ruled that it is unnecessary to wait for a pregnant woman who is scheduled to die for a capital crime to give birth, for the embryo is only a part of her body. That is, the embryo is neither "merely water" nor an independent being deserving of separate moral concern.
Another way to appreciate this difference is in regard to what can be seen. Up to this point of its development, an embryo is too small to be seen by the naked eye. After the 40th day, it slowly comes into the visual field with, among other things, the formation of a thread that eventually becomes the spinal cord. In the view of J. David Bleich, such "subvisual" entities are of no legal or moral consequence in the Judaic legal tradition. See his 2002, 'Stem Cell Research,' *Tradition*, 36,2, pp. 65-67.
[20] See BT *Chullin* 58a. Since this text regards pregnant animals to be sacrificed, some may balk at importing it to speak about human embryology and the status thereof.
[21] Thus, when the rabbis rule about the possible injury sexual intercourse may impose upon an embryo during the first trimester (but it is beneficial for the embryo in the latter two trimesters), it bespeaks a perspective that the embryo's wellbeing should be taken into consideration. Still, it need not be the ultimate, or even a partial, arbiter about what can or should be done with a pregnant woman.

See BT *Niddah* 31a.
[22] See the various discussions between Antonius and R. Judah about the precise timing of ensoulment. BT *Sanhedrin* 91b; *Bereshit Rabbah* 34.10. For other stories about some kind of ensoulment happening within the uterus, see Daniel Schiff's excellent 2002, *Abortion in Judaism*, New York: Cambridge University Press, p. 43.
[23] Exodus 21:22. Translation taken from the new 1999, *JPS Hebrew-English Tanakh*, Philadelphia: The Jewish Publication Society.
[24] Rashi clarifies that the payment is the difference between the going price for a pregnant female servant and an unpregnant one. Rashi at Exodus 21:22, s.v., *'anosh ye'anesh*. See also BT *Baba Kamma* 49a; Deuteronomy 22:19.
[25] M *Ohalot* 7.6; Rashi, BT *Sanhedrin* 72b, s.v., *d'chol zaman*.
[26] MT *Rotzeach* 1.9.
[27] M *Arakhin* 1.4; BT *Arakhin* 7a.
[28] MT *Rotzeach* 1.9. Nachmanides opines that it is required to break Sabbath rules to protect the life of even an embryo because of its potential to be an upstanding Jew (*Torat HaAdam*, *Inyan Sakanah*, §6, p. 29); see also BT *Arakhin* 7a. Rabbi Naftali Tzvi Yehudah Berlin disagrees, reasoning that since an embryo is not a person, no permission is granted to break Sabbath rules (*Ha'amek Sh'eilah to Shiltot* 167.17).
[29] Elliot Dorff makes this argument in his 2003, 'Stem Cell Research,' *Conservative Judaism*, 53,3, p. 19.
[30] See discussion of classic sources in Elliot Dorff's, 1998, *Matters of Life and Death: a Jewish Approach to Modern Medical Ethics*, Philadelphia: Jewish Publication Society, pp. 116-120.
[31] For example, see Fei C., Deroo L.A., Sandler D.P., Weinberg C.R., 2012, 'Fertility drugs and young-onset breast cancer: results from the Two Sister Study.', *Journal of the National Cancer Institute*, 104,13: pp. 1021-7. doi: 10.1093/jnci/djs255.
[32] It should be clarified that what is spoken to humankind in Genesis 1:28 (and earlier to animalkind in Genesis 1:22)—"be fruitful and multiply"—is not a command (*mitzvah*) per se but a blessing (*brachah*). The first command, as such, occurs in Genesis 2:16, when God commands the primordial human to eat carefully or suffer lethal consequences.
[33] Another complicating factor to consider is the marketplace. Should donors of DNA—whether it is directly for research or indirectly once procreation needs have been fulfilled—be remunerated, especially when financial gains may come from the research derived therefrom? This concern is critical, but beyond the scope of this essay.
[34] David Novak, 2007, *The Sanctity of Human Life*, Washington DC: Georgetown University Press, p. 68.