



DRAWING THE LINE

ETHICAL, POLICY, AND
SCIENTIFIC PERSPECTIVES ON
U.S. EMBRYO RESEARCH

HUMAN EMBRYO RESEARCH BEYOND DAY 14: ETHICAL QUESTIONS AND CONSIDERATIONS

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“Human Embryo Research Beyond Day 14: Ethical Questions and Considerations”

This paper examines ethical questions and concerns related to human embryo research. We review the scope and significance of various ethical positions on this research, focusing on factors that might affect it in general as well as beyond 14 days. Given that recent policy discussions address broadening rather than restricting human embryo research guidelines, we pay particular attention to ethical considerations relevant to extending or lifting the 14-day deadline. As scientists begin to seek permission to study embryos older than 14 days, different views about the moral status of the embryo beyond 14 days will become more important.

We explore the concept of moral status in detail, consider whether science alone can establish an entity's moral status, and highlight some of the major accounts of the moral status of human embryos. We also review the implications of different accounts of moral status for human embryo research. Some commentators claim that disputes regarding the embryo's moral status need not be resolved to secure common ground for developing embryo research policy (King 1997). Such a view may rest on an underappreciation of the significance and implications of some understandings of the moral status of human embryos, or on a view about policy development in a morally pluralistic society that easily dismisses dissenting voices.

The moral status of the embryo is, however, not the only consideration relevant to the ethical assessment of human embryo research beyond 14 days. Concerns about the moral status of human embryos are relevant against a background assumption regarding knowledge as a good to be sought. We thus begin with a discussion regarding the value of pursuing knowledge.

Background

“Scientific research is undertaken in the context of social, institutional, regulatory, ethical, and economic pressures, both locally and more globally. Scientists are therefore situated at the interface of complex and competing interests as they aim to uncover fundamental truths, advance knowledge, and foster further discoveries and applications.”

— Robert (2009)

Any scientific undertaking requires significant justification, both internal to science itself (in the form of peer review for validity through publication and funding processes) and external to science (in the form of scientific and/or social significance). Internal justification counts as scientific warrant; external justification counts as moral warrant. Both are required for good science in a democratic society. Scholars have argued convincingly that science lacks the legitimate authority to determine whether a line of scientific inquiry is socially or ethically justifiable (Longino 2002; Jasanoff 2004; Irwin and Wynne 2004; Pielke 2007; Bijker et al. 2009; Douglas 2009; Kitcher 2011); this idea is integrated into scientific oversight committees, which require that nonscientific and community members participate

in reviewing proposed research. The process of determining scientific and social warrant—and significance—is necessarily a collaborative one (Robert 2009).

Scientific research, like all scholarly research, is a social enterprise. It often involves public funding in one way or another. Even with private funding, various socially produced rules, regulations, and norms bind scientific inquiry. Moreover, research has profound effects on society (Jasanoff 2004; Robert 2006; Douglas 2009; Kitcher 2011). It thus is reasonable to subject scientific research to ethical assessment, particularly when such research is highly controversial.

Research that involves the destruction of human embryos is certainly controversial. Some people object to all embryo-destructive research. Others maintain that at least some research on human embryos is permissible, yet they disagree on how to distinguish permissible research from impermissible research based on different factors, such as the developmental stage or age of the embryo, the purpose of the research, and the origin of the embryos. Disagreements regarding the moral status of human embryos remain central to assessing the moral permissibility of human embryo research.¹

In the 1970s and 1980s, when scientists began to pursue human embryo research, two major commissions provided ethical evaluations of such research: the U.S. Department of Health, Education, and Welfare (DHEW) and the U.K. Warnock reports (U.S. DHEW 1979; Warnock 1984). These assessments resulted in what is known as “the 14-day rule,” a widely applied limit for culturing embryos *in vitro* to the 14th day post fertilization (dpf).² Recent scientific advances have led some scientists and policy scholars to call for a new compromise allowing research beyond the original limit (Hyun et al. 2016; Hurlbut et al. 2017). They contend that the 14-day rule was not grounded on a deep moral judgment or consensus about the permissibility of destroying human embryos. From this perspective, if the 14-day limit were not a “moral bright line” beyond which embryo destruction is necessarily wrong, then policymakers may look to extend or lift it without violating a previously discovered ethical constraint. This challenge to the 14-day rule thus calls for a re-examination of classic questions regarding human embryo research and an assessment of new proposals for extending or lifting limits on such research.

¹ Furthermore, research on human embryos intended for reproductive purposes requires separate assessment, and we will not be addressing it here.

² For more details on the DHEW and Warnock reports, see Matthews and Yang (2019) and Matthews and Gallego Marquez (2019).

The Pursuit of Knowledge as a Substantive Normative Consideration

Potentially valuable knowledge can be gained from human embryo research (including embryo-destructive research). Here we briefly explore more generic claims about the value of research in order to provide justification for knowledge claims as moral considerations when assessing the possible extension of the 14-day guideline.

In general, there are two primary reasons for pursuing scientific research: to contribute to fundamental knowledge (sometimes called “curiosity-driven” or “basic” research) and to generate knowledge that might help solve a problem in practice (also called “use-inspired,” “translational,” or “applied” research). Nonetheless, because the distinction between basic science and applied science has been critically interrogated within science studies (Latour 1987; Haraway 1990; Jasanoff 2005; Shapin 2010; Pielke 2012), it has become common to adopt a slightly more complex formulation of the distinction, one that is sensitive to the possibility that there is no such thing as purely basic or purely applied research (Table 1). This formulation, advanced by Stokes (1997), refers to “Pasteur’s Quadrant,” a domain of research that captures the intersection of curiosity-driven and practically oriented science. Stokes (1997) describes a category of Pure Basic Research (without any considerations of utility) and another of Pure Applied Research (without any pretense toward fundamental understanding). While he identifies exemplars of these domains (Bohr and Edison, respectively), they may be more caricatures of science than accurate representations. His important contribution is the description of a domain of research that more adequately captures the kind of approach to science that is meant to be valuable in broad and multiple ways: Use-Inspired Basic Research. This is putatively exemplified by Pasteur (hence “Pasteur’s Quadrant” in Table 1, which is populated by Pure Basic Research, Pure Applied Research, Use-Inspired Basic Research, and a null quadrant of research that aims neither toward fundamental understanding or applicability in the real world).

Human embryo research up to and beyond 14 dpf can be included in any of the three functional quadrants Stokes (1997) describes, as evident in Table 1. The goal of this research may be to fundamentally understand human embryonic development, especially in contrast with the development of our closest living relatives. Alternatively, its goal may be entirely practical in orientation: to improve pregnancy success rates or reduce the incidence of congenital disorders. It is most likely that the aim of pursuing human embryo research, especially beyond 14 dpf, will be some combination of these: for instance, to improve human health outcomes (use-inspired) by characterizing particular unexplored developmental moments (basic research), the discovery of which might also have other unforeseen benefits. The latter consideration includes the prospect of serendipitous discovery, which some commentators claim is absolutely critical to scientific and technological progress.

Table 1. A Pasteur’s Quadrant-style classification of scientific research and its epistemic and/or practical justification

		Consideration of Usefulness?	
		No	Yes
Quest for Fundamental Understanding?	Yes	<p>Pure Basic Research Human embryo research beyond 14 dpf will reveal key aspects of development that are inaccessible via alternative means (e.g., fixed embryo specimens, <i>in vitro</i> or <i>in vivo</i> observation and manipulation of non-human embryos), providing a fundamental understanding of human embryogenesis.</p>	<p>Use-Inspired Basic Research Human embryo research beyond 14 dpf will permit observation and manipulation of developmental trajectories otherwise inaccessible to scientists and clinicians. These exercises will enhance fundamental scientific understanding of human embryogenesis and could lead to novel therapeutic interventions to improve maternal and child health.</p>
	No		<p>Pure Applied Research Human embryo research beyond 14 dpf will permit observation and manipulation of developmental trajectories <i>in vitro</i> to generate novel therapeutic interventions to improve the rate of successful pregnancies and reduce the rate of congenital abnormalities.</p>

Human embryo research up to and beyond 14 dpf could be valuable as Pure Basic Research. From this point of view, knowledge for knowledge’s sake rather than because of its use, is morally valuable. Alternatively, this research could be valuable as Pure Applied Research. From this point of view, it has the potential to benefit human beings and perhaps other entities. It could offer insight into various diseases and potential cures or prevention therapies. Indeed, for some commentators such as the philosopher John Harris (2006) or the bioethicist Laurie Zoloth (2000), the benefits to humans, and particularly human health, that could result from human embryo research make pursuing the research not merely desirable but morally obligatory.

Most scientists, however, will typically offer Use-Inspired Basic Research justifications in proposing research that would require extending the 14-day guideline. Such research is relevant both because of what we can learn regarding embryo development uniquely through extended human embryo research, for instance, and because it can lead to improving human health and well-being.

Whatever the reasons for valuing knowledge acquisition, it is uncontroversial that pursuing knowledge—whether for its own sake, because of the benefits it can provide, or both—is

not the only thing human beings value. Of course, not all quests for knowledge are valuable; scientists seek significant knowledge (Kitcher 2001). Moreover, as the well-justified and widely accepted norms for human research protections show, it is uncontroversial that constraints on such pursuits are ethically justifiable. While some maintain, however naively, that scientists should be left alone to do their research, unencumbered by social mores, the very condition for science is always already social, and it must always be so in a democracy. In such a setting, scientific research must be justified as epistemically significant, excellent, and valuable—especially when other normative considerations (economic, political, or religious considerations, for instance) make the research morally and socially controversial (Robert 2008).

Science and the Moral Status of Embryos

“It is important to recognize that the limit [for permissible embryo research] cannot be set just by knowing what happens at different stages of embryological development. Different developmental markers will have different significance and value for different people. Although it might be possible to describe the biological processes with growing confidence, it is not possible to determine scientifically whether culturing embryos to such and such a stage is right or wrong.”

— Hurlbut (2017)

The term “embryo” is widely accepted as the mass of cells in the earliest stages of development of a new organism.

Scientists define the human embryo as the time from fertilization to the eighth week of gestation (56 dpf), when it becomes known as a fetus and starts to develop more advanced physical and neurosensory features (Sadler 2005).

U.S. federal law does not define the term embryo; instead, it defines a fetus as the entity from the implantation stage

(which scientists define as 7-14 dpf) to delivery. For this paper, we will use the term “embryo” to describe the time of development from conception to 56 dpf (with “fetus” referring to the *in utero* entity from 56 dpf until birth).

Scientific research must be justified as epistemically significant, excellent, and valuable—especially when other normative considerations make the research morally and socially controversial.

Scientific Definitions Cannot Do All the Moral Work

Some commentators have appeared to suggest that scientific evidence regarding the human embryo by itself provides the essential data for answering questions about its moral status and, by extension, what may and may not be done to an embryo. From this perspective, a scientific description of an embryo’s characteristics, such as if it can feel pain or if it exhibits characteristically human electrical brain activity, dictates what moral consideration we owe it (e.g., Morowitz and Trefil 1992).

Others have argued that characterizing an entity in scientific terms is hardly sufficient to determine whether it has moral status or what degree of moral status it has. This is descriptive work, not normative work (Hurlbut 2017; Khushf 1997; Maienschein 2014). A description cannot by itself account for what obligations, if any, we have toward the embryo or whether an embryo has rights. Likewise, it is insufficient to provide an account about the conditions under which we may violate a human embryo's rights, if it has any, or the circumstances under which we could leave our obligations to or regarding embryos unfulfilled, if we have any. Scientific descriptions provide us with significant information when making determinations about moral status, but they do so in combination with substantive normative judgments.

This inability of scientific descriptions to provide specific moral insight or guidance does not only affect human embryos. Scientific descriptions of other entities, such as adult humans and rodents, do not tell us how we ought to treat them either. The human and animal research ethics literature shows that there are dramatic disagreements over what may and may not be done to various research subjects under different circumstances. Scientific descriptions of these subjects do not resolve these conflicts. Similarly, a clear scientific account of the human infant does not resolve debates over the permissibility of infanticide, which some authors defend under various circumstances (Giubilini and Minverva 2013; Kuhse and Singer 1985).

It is not surprising, then, that scholars relying on the same scientific descriptions of human embryos can come to different conclusions about what may and may not be done to them (Box 1). The view that science can resolve questions about the moral status of embryos might rest on a mistaken understanding of the relationship between scientific and normative claims (claims about what ought to be or what actually is morally right or wrong). Alternatively, it might be part of a calculated attempt to control the discourse and facilitate human embryo research. Science generally is treated as having special epistemic authority, and turning normative questions about research over to science could be a shortcut to facilitate research (Hurlbut 2017; Khushf 1997; Maienschein 2014). However, we cannot take for granted that science should play any particular role since that is precisely what is in question (Robert 2009).

Box 1. Contrasting Views of the Moral Status of a Human Embryo**FULL Moral Status**

A human embryo is not something different in kind from a human being, like a rock, or a potato, or a rhinoceros. A human embryo is a whole living member of the species *Homo sapiens* at the earliest stage of her natural development. Unless severely damaged or denied or deprived of a suitable environment, an embryonic human being will, by directing her own integral organic functioning, develop herself to the next more mature developmental stage—the fetal stage. The embryonic, fetal, child, and adolescent stages are just that—stages in the development of a determinate and enduring entity—a human being—who comes into existence as a single-celled organism (a zygote) and develops, if all goes well, into adulthood many years later.

Source: George and Tollefsen (2011, 50)

NO Moral Status:

The moral status of the embryo [...] is determined by its possession of those features which make normal adult human individuals morally more important than sheep or goats or embryos. [...] It is clear that at no stage of its development does the human embryo nor yet the human fetus possess these characteristics.

Source: Harris (1990, 79)

SOME Moral Status, But Not Because of Biology Alone:

The special status of the human embryo and the protection to be afforded to it by law do not in our view depend upon the decision as to when it becomes a person. Clearly, once that status has been accorded all moral principles and legal enactments which relate to persons will apply. But before that point has been reached the embryo has a special status because of its potential for development to a stage at which everyone would accord it the status of a human person.

Source: Warnock (1984, 90)

Scientific Definitions Still Matter for Moral Purposes

Although scientific descriptions of the embryo are not sufficient to determine moral claims, they are relevant to moral considerations. Insofar as certain biological characteristics are thought to be necessary or sufficient for moral status, for example, science can help us in determining whether embryos have the characteristics in question and when they acquire them. For instance, philosopher George Khushf contends “there is fairly broad consensus that in order to be a person (however one defines that), one must at least be a developmentally unique individual” (Khushf 1997, 505). Science can provide information about whether the embryo is a unique individual or when it becomes one. Science shows that embryos can twin before 14 dpf and not thereafter. Therefore, many scholars think that embryos are not unique individuals and thus cannot have full moral status prior to that time. This reasoning might explain why human embryo research policy over the past several decades has taken the appearance of the primitive streak around 14

dpf to have great moral significance, as reflected in the work of the U.S. DHEW report (1979), the U.S. National Institutes of Health (NIH) Human Embryo Research Panel (HERP) (1994), and the U.K. Warnock Report (1984). In this view, although they might still not have any degree of moral status after 14 dpf, it would be impossible for embryos to have moral status before that time. Despite claims to the contrary, this view is not universally held. Some scholars argue that all human embryos have moral status (see below).

Moral Status

‘Moral status’ (or sometimes the term ‘personhood’ of the embryo is used instead) plays an important role in assessments of the moral permissibility of human embryo research. Philosopher Mary Anne Warren describes moral status in terms of obligations (see Box 2; Warren 1997, 3). She views moral status as helping us “make sense of our moral obligations towards human beings and the rest of the natural world” (Warren 1997, 3). Understood this way, to describe an entity as having moral status is to make a very general claim about it and what we may and may not do to it. Used this way, moral status does not entail anything about what interests or rights an entity has, how they might be identified, how significant they are, how much consideration they ought to be given, whether they impose any side-constraints or absolute restrictions on others’ actions, or whether we have any strict positive obligations toward the entity. All that having moral status entails in Warren’s (1997) definition is that the “needs, interests, or well-being” of the entity in question must be taken into account for its own sake.

Box 2. Defining Moral Status

To have moral status is to be morally considerable, or to have moral standing. It is to be an entity towards which moral agents have, or can have, moral obligations. If an entity has moral status, then we may not treat it in just any way we please; we are morally obligated to give weight in our deliberations to its needs, interests, or well-being. Furthermore, we are morally obligated to do this not merely because protecting it may benefit ourselves or other persons, but because its needs have moral importance in their own right.

Source: Warren (1997, 3)

To say that an embryo has moral status does not mean that it necessarily merits the same consideration given to an infant, a young child, a teenager, an adult, and so on. Nor does it mean that its interests, needs, or well-being may never be undermined. Moreover, even if an embryo’s interests do not matter for its own sake, we might nonetheless have obligations to others, such as the people who created the embryo, that prohibit us from doing certain things to embryos.

Positions regarding the moral status of embryos range from the view that human embryos have no moral status at any point, to the view that embryos at varying stages have some degree of moral status, to the view that embryos (either from fertilization or from some later point) have full moral status (i.e., their moral status is no different from that of a cognitively unimpaired adult human, Box 1). As noted above, George and Tollefsen (2011) argue that the human embryo has the same moral status as an adult human being. In contrast, John Harris has compared the human embryo to the Sunday roast, suggesting that it is the kind of thing we can destroy for nourishment or to satisfy our tastes (Harris 1990).

Some commentators who hold that embryos have no moral status rely on intuitions and attitudes about early embryos in non-research settings to support their claims. Several philosophers, including Sissela Bok (1988), Thomas Douglas and Julian Savulescu (2009), George Annas (1989), and Michael Sandel (2005), argue that since there is so much embryo loss naturally, it would be seen as a major health emergency if we really thought embryos were persons. We would put significant resources into understanding and preventing such losses, abortion would be recognized as murder, and miscarriages would be treated like infant deaths (Bok 1988).

Ronald Green (2001) reasoned that widely accepted practices affecting embryos outside of the research context inform views about their status. Since Americans routinely accept the use of potentially abortifacient contraceptives such as intrauterine devices (IUDs), we must believe that embryos are the kinds of things it is permissible to destroy (Green 2001, 62). The NIH HERP offered the generally accepted early mortality of many embryos and the common practice of discarding or indefinitely freezing embryos subsequent to *in vitro* fertilization (IVF) as evidence that embryos do not have the moral status of persons (U.S. NIH 1994, vol. 1, 36).

One difficulty with such views is that commonly held intuitions and widely accepted practices might simply be wrong, or the intuitions might not be as widely shared as the authors assume. To make this point, George and Tollefsen (2011) describe Noah, a frozen embryo who was rescued from a flooded hospital in New Orleans after Hurricane Katrina in 2005. Noah was born 16 months after Katrina. George and Tollefsen (2011) argue that the Noah who was born and whose parents love him is the same Noah who started out as an embryo. Noah would have died had it not been for the police officers who salvaged the canisters containing Noah and many other frozen embryos. The force of the claim that early embryos are not morally significant beings for their own sake might rest on the failure to consider the situation carefully, the authors argue. For George and Tollefsen (2011), if we follow Noah's story, then we might readily conclude that embryos are lost when IUDs prevent implantation and that such cases are accurately described as involving the death of a human in its earliest stages. The fact that some people are not bothered by this might mean that they have poorly formed intuitions about the continuity of our identity over time. George and Tollefsen (2011) might argue that

the (poorly formed) intuitions many people have about such matters need not give us reasons to think Noah was not Noah.

One important difference among accounts of moral status is whether moral status is an all-or-nothing concept (binary) or admits of degrees. If moral status is binary, then an entity either has it or does not. Under this account, an entity that meets the criteria for moral status would have full moral status while an entity that lacks such characteristics would have no moral status at all (until it acquires them, if it ever does so). Binary accounts of moral status might contend that embryos have full moral status from fertilization, while others might not recognize embryos as having full moral status until some later developmental age.

Nonbinary accounts of moral status can recognize embryos as having varying degrees of moral standing or status. Variations along the spectrum depend in part on views about the necessary and sufficient conditions entities must meet to have a degree of moral status, and the extent to which embryos do or do not meet them.

In the public and scholarly debate over human embryo research, we often see ‘moral status’ distinguished from ‘moral consideration,’ ‘respect,’ ‘dignity,’ ‘special status,’ ‘special character,’ ‘value,’ or ‘moral standing.’ These terms usually are not clearly defined and they might mean different things in different contexts. Nonetheless, such terms call attention to embryos having some type of value such that they should be treated in certain ways. For instance, the U.S. DHEW Ethics Advisory Board (EAB) concluded that while human embryos deserve respect, this does not mean that they necessarily should be treated like persons (U.S. DHEW 1979; see Steinbock, 2011, 27 for a similar view). The Warnock report concludes that “because of the special status that we accord to the human embryo, such research must be subject to stringent controls and monitoring” (1984, 64). Attributing ‘respect,’ ‘standing,’ or ‘consideration’ typically is a middle path between those who reject human embryo research on the grounds that the full moral status of embryos makes it wrong to kill them and those who see nothing wrong with destroying embryos.³ Beliefs about partial moral status and about what may be done to entities with such status also depend in part on views about the permissibility of undermining some interests or rights to advance other goals.

Sometimes the literature reflects a desire to set moral status aside and to focus on other considerations that could inform judgments about human embryo research, such as the importance of scientific knowledge or advancing human health. Such a move is plausible only if one holds certain views about the moral status of human embryos or appeals to particular frameworks (such as a strict utilitarian account) for ethical reasoning. If one takes embryos to have full moral status and to deserve the

³ To be sure, it is difficult to imagine anyone who legitimately would claim that they “see nothing wrong with destroying embryos.” For instance, even scientists who engage in embryo-destructive research do not take this work lightly, and they actively seek strategies to destroy as few embryos as warranted for their research.

same respect accorded to adult humans, then it is difficult to argue that we should disregard this status and focus instead on the possible benefits to humanity that human embryo research affords.

Another important difference in accounts of moral status concerns the necessary and sufficient conditions for having full moral status or a particular degree of moral status. In some accounts, only one criterion is thought relevant, whereas for others multiple factors contribute to an entity having full moral status or a higher or lesser degree of it.⁴ In the next section, we review the most common grounds for moral status. Judgments about what may be done to entities that have full or partial moral status rely on additional considerations about what such status entails, which we consider in later sections.

What Are the Grounds for Granting Moral Status to Human Embryos?

Significant disagreements exist over what characteristics are necessary and/or sufficient to confer moral status. Even when scholars agree about the fact that one or some particular characteristics confer moral status, they sometimes disagree over whether embryos have the characteristic(s) in question (Box 3). Disagreements also exist over what it is about those characteristics that makes them appropriate grounds to confer special status to those who have them. There are also disparities about how an entity with full or partial moral status should be treated.

Some caveats are in order. First, in describing some of the characteristics used to determine whether human embryos have any moral status, we do not seek to resolve the debate. Thus, we do not critically assess the different accounts. Our goal is simply to show the scope of the debate and the significance of these views for assessing the permissibility of human embryo research and for developing relevant policies. Second, our discussion is not exhaustive.

We present only the main accounts that have shaped the ethics and policy literature. Finally, we are focused on human embryos and do not discuss other entities with embryo-like features (Aach et al. 2017). While these entities might have similarities with human embryos, they also have relevant differences.

Species Membership

Being part of a species, such as the human species, whose members typically have sophisticated cognitive capacities, has been posited as necessary and/or sufficient grounds for having full moral status (Dworkin 1973; Benn 1967). Under this account, even when a particular entity, such as a human embryo or an adult in a coma, does not have those capacities itself, it is still thought to have full moral status. Given that human

Box 3. Potential Characteristics Conferring Moral Status

- Species Membership
- Individuality
- Physical Characteristics
- Cognitive Capacities
- Potentiality

⁴ See Warren (1997) and Tauer (1997) for a discussion of pluralistic approaches to moral status.

embryos are humans and not frogs, ants, apples, elephants, or anything else in terms of their genetic makeup, they are members of the human species.

While some scholars agree that human embryos belong to the human species, they question why species membership is relevant for moral status. They charge those who claim that species membership is necessary and/or sufficient for moral status with arbitrariness (Feinberg 1980; Singer 1974). Others distinguish between humans as biological organisms and humans as persons (Warren 1993; Little 2008). On these accounts, even if belonging to the human species confers some degree of moral status, only persons have full moral status. Of course, the task is then to determine the conditions for “personhood.”

Significant disagreements exist over what characteristics are necessary and/or sufficient to confer moral status.

Individuality

Some commentators hold that a necessary, though not sufficient, requirement for having full moral status is that an entity be a unique individual. Many contributors to the human embryo research debate have defended or adopted the view that as long as one embryo can become two, it is not a unique individual and thus cannot have full moral status (U.S. DHEW 1979; U.S. NIH 1994; Ford 1989; McCormick 1991; Porter 1995).

This view was used to forge agreement among several policy bodies and commissions, such as the Warnock Commission and the DHEW EAB, on the permissibility of human embryo research before the appearance of the primitive streak at 14 dpf. Prior to this point, twinning is possible and thus, some contend that embryos cannot be unique individuals (see Tauer 1997, 430).

For others, however, although individuality is relevant for moral status, it is mistaken to insist that embryos before 14 dpf are not unique individuals simply because of the possibility of twinning (see George and Tollefsen 2011). They contend that most embryos will not twin and thus most are unique individuals even in the sense of the term used by the NIH HERP and others. From this point of view, even for those that twin, there is no reason to assume that what exists before twinning is not a unique individual. Instead it can be viewed that before twinning there is one unique individual and after twinning, there is a second unique individual (see George and Tollefsen 2011, 148-9). Here, destroying an embryo before it twins would mean that one killed an individual and prevented the potential development of a second individual—which could be seen as morally worse than destroying one individual (even past 14 dpf).

Physical Characteristics

Any number of physical characteristics might be treated as necessary and/or sufficient conditions for full or partial moral status. In the HERP's discussions, some argued that the beginning of neural development (gastrulation and neurulation) was important because it was essential for "the possibility of sentience and most other qualities considered relevant to the moral status of persons" (U.S. NIH 1994). For others, a more developed nervous system, rather than merely having the beginning of a nervous system or some neural tissue, must be in place for an entity to have "the possibility of sentience."

Yet others contend that moral status requires more advanced physical characteristics than those that allow for the possibility of sentience. For instance, some argue that the physical characteristics necessary to have sophisticated cognitive capacities are necessary for moral status (see below for discussion of this).

Some commentators have posited viability, or possessing the ability to live outside the womb, as a physical characteristic required for moral status. For instance, in discussing abortion, viability sometimes is taken to be the marker for when the state may justifiably interfere with a woman's right to seek an abortion (Campbell 1985). However, viability is a consideration when embryos are implanted in a woman's uterus en route to becoming a fetus and eventually a child. *In vitro* embryos in research contexts, as such, are not viable in any morally relevant way, in that they are always already *ex utero*.

Cognitive Capacities

Full or partial moral status might require any one (or more) of a number of cognitive capacities, from sentience, understood as the mere ability to experience pleasure or pain, to sophisticated cognitive capacities such as self-awareness, the capacity to set ends or have goals, or the capacity to value (see Sumner 1981; Regan 2004; DeGrazia 1996; Rachels 1990; Tooley 1976).

For some, sentience is sufficient for at least some degree of moral status because it involves the ability to experience pleasure and pain, and any being that has interest in not suffering or in feeling pleasure deserves us to take those experiences into account for their own sake (Singer 1993; DeGrazia 1996, 2008). Sentience, in this sense, emerges in fetal development somewhere between 18 and 25 weeks post-fertilization and therefore is not present in embryos (Tawia 1992; Van de Velde 2006; Bellieni 2012).

Others argue that more sophisticated cognitive capacities are necessary for full moral status. John Harris, for instance, contends that full moral status "is determined by [an entity's] possession of those features which make normal adult human individuals morally more important than sheep or goats or embryos" (1990, 79). He describes this in terms of "self-consciousness, which involves a person's

being able to ‘consider itself as itself in different times and places’ [...] awareness of awareness [...] the ability to want to experience the future, or to want not to experience it and the awareness of those wants” (Harris 2006, 17-18). Tooley similarly holds that “an organism possesses a serious right to life only if it possesses the concept of a self as a continuing subject of experiences and other mental states and believes that it is itself such a continuing entity” (Tooley 1972, 44). Embryos and fetuses do not have these characteristics, he says, and therefore do not and cannot have full moral status.

Bonnie Steinbock leaves open the possibility that sentience confers some degree of moral status while acknowledging that full moral status requires more than mere sentience. She thinks that it is not necessary to settle that question to establish that embryos do not have any degree of moral status:

We should recognize that moral persons are those beings who have certain capacities, including at least some of the following: sentience, consciousness, self-consciousness, reasoning, and language. Anyone who has all of these is a person, and anyone lacking in all of these capacities isn’t a person, no matter to what species he or she belongs. Embryos have no person-making characteristics. Therefore, they do not have a right to life, and abortion is morally legitimate. Equally, embryos are not human subjects and may be used in research. (Steinbock 1994, 30)

Although many agree that embryos lack any of the sophisticated cognitive capacities described here and thus on those grounds they lack full moral status, Robert George and Alfonso Gómez-Lobo (2005) challenge this assumption. They distinguish between basic natural capacities and immediately exercisable capacities. Even if full moral status were to require sophisticated cognitive capacities, this need not entail that the capacities be immediately actualized:

It is clear that one need not be actually conscious, reasoning, deliberating, making choices, etc., in order to be a human being who deserves full moral respect, for it is clear that people who are asleep or in reversible comas deserve such respect. So, if one denied that human beings are intrinsically valuable in virtue of what they are, but required an additional attribute, the additional attribute would have to be a capacity of some sort, and, obviously a capacity for certain mental functions. (George and Gómez-Lobo 2005, 202)

Unlike a potentiality view (described below), George and Gómez-Lobo (2005) claim that embryos do have the capacity and not just the potential for the capacity. This capacity is simply not immediately exercisable, much like people who are asleep, under anesthesia, or in a reversible coma are thought to have capacities for mental function even though they cannot exercise them at that moment.

Potentiality

Whether full or partial moral status depends on physical or cognitive characteristics or some combination of them, some commentators hold that an embryo need not actually have these characteristics to have moral status. On this account, entities have moral status, full or otherwise, because they are the kinds of beings that have the potential to develop those capacities or characteristics. Phillip Devine (1978) and John Marshall (1990) advance this position.

For some, potentiality confers only “a minor degree of moral status” but not full moral status (Strong 1997, 470). This position is advanced in the Warnock report:

The special status of the human embryo and the protection to be afforded to it by law do not in our view depend upon the decision as to when it becomes a person. Clearly, once that status has been accorded all moral principles and legal enactments which relate to persons will apply. But before that point has been reached the embryo has a special status because of its potential for development to a stage at which everyone would accord it the status of a human person. (Warnock 1984, 90)

Even if one accepts the potentiality criterion, some scholars argue that embryos—or at least some embryos—lack it. For instance, *in vitro* embryos left over from IVF that will not be transferred for gestation and embryos that are created specifically for research purposes do not have the potential to become persons because they will never be transferred for gestation (see Steinbock 2006).

Others reject potentiality as a sufficient characteristic for any degree of moral status because of the putatively absurd consequences that such a claim would involve. Some have claimed that if the potential to develop into a certain kind of organism is sufficient to confer some degree of moral status, then gametes would have some moral status as well (Kuhse and Singer 1982). Others have rejected the analogy between embryos and gametes. For example, the Warnock report contends that:

It is true that the ovum and sperm are genetically unique but neither alone, even in the most favourable environment, will develop into a human person. They do not have this potential. The embryo, on the other hand, given the appropriate environment, will develop to the stage at which there would be general agreement that the status of a person be accorded to it. (Warnock 1984, 91)

Implications of Claims About Moral Status

As discussed previously, scientific information is insufficient to determine whether it is morally permissible to destroy human embryos for research purposes. Similarly, judgments about whether embryos have moral status or

Scientific information is insufficient to determine whether it is morally permissible to destroy human embryos for research purposes.

what degree of moral status they have are also insufficient to settle questions about the moral permissibility of human embryo research at any stage of development. Determining that an entity has moral status only tells us that its interests morally matter to some degree for its own sake. It does not tell us how much they matter or how they ought to matter, if at all (Warren 1997).

From a utilitarian approach, moral status or moral considerability simply calls for having one's interests computed in the calculus that establishes which action will bring about the greatest utility and the least disutility. Hence, the moral significance of the claims of embryos—to not be destroyed—would depend on what other morally significant competing claims are at stake. Those competing claims might include the acquisition of new knowledge for its own sake and the potential benefit to human health outcomes of conducting human embryo research—claims that themselves must be scientifically and socially well justified.

Even from a non-utilitarian perspective, having moral status can fail to be a decisive factor regarding the permissibility of human embryo research. That an entity has moral status thus tells us that it enjoys certain privileges that other beings who lack that status do not. But what those privileges might be depends on other substantive moral claims.

Regardless of what view of the moral status of embryos policymakers and others accept, questions remain about the implications of that status for the 14-day rule. Below we explore the implications that having or not having moral status has for the debate over extending or lifting the 14-day rule. Our concern here is not with claims about whether embryos have or lack moral status or on what grounds they do so. Thus, in what follows we assume a particular moral status, or lack thereof, for embryos and examine the implications for extending or lifting the 14-day guideline.

Full Moral Status and Extension of the 14-Day Guideline

Some commentators who oppose human embryo research argue that embryos have full moral status. They therefore contend that human embryos deserve the same protections as adult, cognitively unimpaired human beings who are paradigmatic entities with full moral status (George and Tollefsen 2011). Philosophers in general agree that at a minimum, having full moral status involves a strong presumption against acting in certain ways toward the being in question, such as destroying it, experimenting upon it without permission, etc. (Kamm 2007).

If embryos have full moral status, society has a strong moral reason not to destroy them. This would be the case even if doing so could provide us with valuable knowledge that might eventually save the lives of other beings with full moral status. Just as we have very stringent reasons against killing cognitively unimpaired adults to advance scientific knowledge, under the assumption that embryos have full moral status we would also have a very stringent reason not to destroy them for research purposes. Indeed, that a being has full moral status means that certain conflicting reasons would be silenced from

consideration. For instance, that destroying embryos in research could produce financial benefits or that the research would advance the career of some scientists would not be good reasons to use embryos in research.

The fact that a being has full moral status provides us with a stringent moral reason against interfering with it. Nonetheless, such a reason may be overridden in some narrow cases. For example, that destroying an entity with full moral status would save the lives of a very large number of other beings with full moral status, may constitute an overriding reason (Kamm 2007).

Few, if any, commentators would argue that gaining knowledge, even very beneficial knowledge, would count as a reason to override the strong presumption against interfering with entities that have full moral status. Witness, for instance, current regulations regarding human research protections. Individuals who attribute full moral status to embryos believe that destroying embryos for the sake of obtaining knowledge—even knowledge that could eventually contribute to saving many people's lives—is morally impermissible.

How would a claim of full moral status for embryos affect the possibility of extending or lifting the 14-day rule? It depends on what individual characteristics ground full moral status and when an embryo acquires them. As we discussed previously, some argue that species membership is a sufficient ground for full moral status (e.g., George and Gómez-Lobo 2005). From this point of view, embryos have full moral status from the moment of fertilization, and this would give us a stringent moral reason against destroying them for research purposes. Similarly, if embryos have full moral status by virtue of their potentiality to become human persons, that would also give us a stringent moral reason against using them in research.

Grounding full moral status on these characteristics would thus have little effect on extending or lifting the 14-day rule. If embryos have full moral status from the moment of fertilization, embryonic research *at any stage of development* would be morally impermissible. Even if embryos acquired other characteristics relevant for moral consideration as they develop, it would not affect the already existent stringent reason not to destroy them on grounds of their full moral status. It might be the case that certain developmental traits, such as the existence of neural tissue, could give us additional reasons not to destroy human embryos. Such reasons, however, would have little to do with the embryos' moral status.

On the other hand, if some other characteristic (e.g., sentience, certain cognitive or emotional capacities) were necessary to confer full moral status on embryos, this would count as a reason for the permissibility of extending or lifting the 14-day rule. Most agree that embryos, even beyond 14 dpf, lack sentience or cognitive and emotional capacities. Thus, grounding full moral status on those characteristics would mean that embryos do not have full moral status and that human embryo research beyond day 14 is in principle morally permissible.

Nonetheless, the fact that embryos would lack full moral status during certain developmental stages does not mean that there are no other reasons against using them in research. Perhaps before they acquire full moral status, embryos have a lesser degree of moral status that counts as a reason against destroying them (see below for discussion of lesser moral status). Or perhaps considerations other than the moral status of embryos can play a role in judgments about whether to use them in research (see below for discussion of no moral status). Simply stated, the fact that embryos lack full moral status is insufficient by itself to conclude that extending or lifting the 14-day rule is morally appropriate.

Table 2. Provenance of Embryos and Moral Status: Implications for Human Embryo Research Beyond 14 dpf

Depending on moral status and embryo provenance, research on human embryos is morally impermissible (red) or permissible (green).

	Embryos Created for Research	Embryos from IVF
Full Moral Status	Morally impermissible at any stage of development as embryos have the same status as persons	Morally impermissible at any stage of development—no differences in embryos based on provenance
		Morally permissible to extending or lifting deadline if embryos will be destroyed anyway
Lesser Moral Status	Morally impermissible if lesser moral status entails a strong reason against killing	Morally impermissible if lesser moral status entails a strong reason against killing
	Morally permissible if significant knowledge is likely to be gained	Morally permissible if significant knowledge is likely to be gained
No Status	Morally impermissible because inconsistent with the respect owed to embryos	Morally permissible provided appropriate safeguards exist to ensure safety and autonomy of gamete providers
	Morally permissible provided appropriate safeguards exist to ensure safety and autonomy of gamete providers	

The full moral status of embryos could also have implications for the debate over whether it is morally better to use embryos left over from IVF treatments than to create new embryos for research and whether those embryos can be used beyond 14 dpf (Table 2). If embryos have full moral status from the moment of conception, their provenance would not affect such status and thus would not affect the stringent reason against destroying them for research purposes at any stage of development. However, as

we mentioned earlier, many believe that this stringent reason can be overridden in some narrow cases. It might be that in cases where the embryos will be destroyed anyway, it could be permissible to use them for research even if they have full moral status. For instance, it may be morally permissible to kill an individual who is about to be killed by someone else if killing the individual were to result in significant benefit to others (Curzer 2004). Thus, if embryos left over from IVF treatment will be destroyed, it could be permissible to use them for research purposes at any stage of development, particularly if such research is expected to provide significant benefits. Creating embryos explicitly for research purposes would, however, be morally impermissible in this view (President's Council on Bioethics 2002).

Nonetheless, the permissibility of using leftover IVF embryos for research crucially depends on the assumption that they would be destroyed anyway at some point. However, many who believe that embryos have full moral status contest this assumption. If a couple prefers not to use embryos created to fulfill their reproductive goals, they could decide to maintain the frozen embryos indefinitely, or they could donate the embryos to another couple for reproductive purposes.

Furthermore, on at least some accounts of full moral status (Jaworska 2007; Quinn 1984), that an entity has full moral status gives us a strong reason to rescue it. Under this assumption, if embryos have full moral status, we should not destroy them, and instead we must ensure that they are given the chance to develop into human persons. Of course, various other considerations are relevant in fulfilling this duty to rescue. For instance, there must be a woman willing to have the embryos transferred. Similarly, we must obtain the agreement of the couple from whose gametes the embryo has been created. Thus, if embryos have full moral status from the moment of fertilization, the fact that the original couple does not plan to use them for reproductive purposes would not be a sufficient reason to make the use of these embryos in research morally permissible. Therefore, extending the deadline would likewise be morally wrong. Moreover, those who take embryos to have full moral status would also want to challenge the practices that result in "excess" embryos in the first place (Khushf 1997).

Lesser Moral Status and the Extension of the 14-Day Guideline

Some moral theories take moral status to be an all-or-nothing property. An entity has either full moral status or no moral status (Kant 1998 [1785]). Other theories allow for degrees of moral status. In this case, some entities are thought to have full moral status while others have a lesser moral status but are still entities whose interests matter for their own sake rather than simply for the sake of others. In these accounts, embryos could be entities with a lesser degree of moral status either because they fail to have all the necessary characteristics to have full moral status or because they have them to a lesser degree.

The degree of moral status affects the strength of the reasons against interference. Full moral status entails a very strong presumption against killing an individual that

can only be overridden under a very narrow set of conditions. Having a lesser degree of moral status could weaken the strength of the reasons not to interfere, as well as broaden the circumstances that can outweigh them (DeGrazia 2008; McMahan 2002; Strong 1997).

How would a claim of lesser moral status for embryos affect the possibility of extending or lifting the 14-day rule? This depends on at least two things (Table 3):

1. The characteristics that confer some, but not full, moral status; and
2. Moral assumptions about what it means to have a lesser degree of moral status.

Table 3. Implications for Embryo Research Beyond 14 dpf if Embryos Have a Lesser Degree of Moral Status

Characteristics conferring a lesser moral status	Strong presumption against killing that overrules common good considerations	Presumption against killing outweighed by what maximizes the common good	Weak reasons against killing
Species Membership	Impermissible	Permissible (until embryos acquire full moral status)	Permissible (until embryos acquire full moral status)
Potentiality	Impermissible	Permissible (until embryos acquire full moral status)	Permissible (until embryos acquire full moral status)
Individuality	Permissible before day 14 only*	Permissible before and after day 14 (until embryos acquire full moral status)	Permissible before and after day 14 (until embryos acquire full moral status)
Sentience	Permissible at any stage of embryonic development	Permissible at any stage of embryonic development	Permissible at any stage of embryonic development
Cognitive Capacities	Permissible at any stage of embryonic development**	Permissible at any stage of embryonic development	Permissible at any stage of embryonic development

* As indicated above, most commentators argue that individuality appears after development of the primitive streak at 14 dpf because prior to that point twinning is possible. Nonetheless, see George and Tollefsen (2011) for disagreement with the claim that embryos are not unique individuals before day 14. Under this assumption, human embryo research would be morally impermissible also before day 14.

** As with the case of individuality, most take embryos to be entities that lack sophisticated cognitive capacities. However, as pointed out earlier, George and Gómez-Lobo’s (2005) distinction between natural and immediately exercisable capacities challenges this belief. Under this assumption, human embryo research would be morally impermissible at any stage of development.

For instance, if being a member of the human species or potentiality confer some, but not full, moral status, then embryos from the moment of fertilization would have some moral status. If individuality were insufficient for full moral status but necessary for a lesser degree of moral status, then the appearance of the primitive streak around 14 dpf would confer some moral status on embryos after that point. If sentience were necessary for an entity to have even a lesser degree of moral status, then embryos would lack moral status throughout their development as embryos.

Determining whether or not embryos have the necessary characteristics to have a lesser degree of moral status is, however, insufficient by itself to dictate a particular action regarding human embryo research and thus to determine what to do about extending or lifting the 14-day rule.⁵ Other substantive normative assumptions are also necessary for judgments about the moral permissibility of such research beyond 14 dpf. For instance, it might be that an embryo having some moral status would give others a reason not to destroy it, but that maximizing the common good would override such a reason (McMahan 2002). Or it might be that having some moral status involves judgments about what types of reasons apply, and not judgments about their strength. In this case, having some lesser degree of moral status could entail a very strong reason against killing but not a duty to rescue. Thus, embryos having some moral status after 14 dpf would give us a reason not to destroy them and thus not to extend or lift the deadline indefinitely, depending on when this moral status emerges developmentally.

For many who contend that embryos have a lesser degree of moral status, the fact that research on human embryos could result in significant knowledge and the possibility of developing new life-saving medical interventions count as overriding reasons to use embryos in research. Hence, recommendations related to the moral permissibility of extending or lifting the 14-day rule when embryos are thought to have some degree of moral status would consider issues such as the significance of knowledge acquired after 14 dpf, and whether there are other ways to secure such knowledge that do not involve destruction of entities with at least some moral status. It is precisely these sorts of normative considerations that must be taken into account when science is funded by the public.

Of course, moral status could come not just in two degrees—full and lesser—but various forms, such that entities with less than full moral status could have greater or lesser degrees of it. For example, a dog could have a higher moral status than a fish, and a fish higher than a mollusk. Such differences in degree could affect what may or may not be done to the entities in question and what reasons would override the obligations we have to them. For instance, we might have stronger reasons not to kill a dog than not to kill a mollusk. This could be because of the

⁵ There are some background assumptions in play here, especially about normal embryonic development *in utero* and what we might see in human embryonic development *in vitro* past 14 dpf. We do not know whether there will be developmental differences between human embryos *in vitro* vs. *in utero*.

social and symbolic roles that dogs play; similar considerations might animate intuitions about human embryos.

Importantly, most accounts of what confers some degree of moral status would have little effect on the debates over extending or lifting the 14-day rule. Embryos either have those characteristics from the moment of fertilization (e.g., potentiality, species membership) or they never have them (e.g., sentience, sophisticated cognitive capacities). For example, if potentiality is the main characteristic determining moral status, and having a lesser moral status involves a strong presumption against killing that is not overridden by considerations of the common good, then research with embryos would be morally impermissible at any stage of development, as potentiality is a characteristic that exists from the moment of creation.⁶ The 14-day limit and its extension would be equally affected by this judgment. Similarly, if having a lesser moral status involves a presumption against killing that is overridden by considerations about knowledge acquisition or better medical interventions, then human embryo research could be morally permissible at least until embryos acquire characteristics conferring full moral status. Whether research is permissible or not would depend on the importance of the knowledge to be gained by using embryos and not on the moral status account.

Likewise, if a lesser moral status involves only a weak presumption against destruction, and again, given that potentiality is present from fertilization, then research with embryos would be permissible before 14 dpf and until the embryo acquires full moral status. Of course, those who argue that potentiality confers a lesser degree of moral status might believe that other traits embryos acquire in their development, such as neural tissue, confer full moral status on embryos, and thus, they might believe that research with embryos would be morally impermissible after that point.

The same can be said about characteristics such as sentience or sophisticated cognitive capacities. Given that embryos lack these characteristics during the embryonic developmental stages, they cannot confer any degree of moral status. Under this assumption, embryos would simply lack any moral status. Of course, to the extent that embryos could acquire higher degrees of moral status as they develop, the potential benefit to be gained from research would have to increase to justify research on more developmentally advanced embryos.

However, extension of the 14-day limit could be affected if the characteristic that confers a lesser moral status is individuality. Recall that an embryo cannot twin after the appearance of the primitive streak at 14 dpf, and thus many believe it

⁶ This need not equate lesser and full moral status for embryos. It might be the case that both full and lesser moral status outweigh considerations of the common good. Nonetheless, in cases of conflict between entities with full and lesser moral status, we have a stronger reason not to kill an entity with full moral status than one with lesser moral status. When entities have the same moral status, we would need to attend to other considerations.

becomes a unique individual after this point. Embryos would therefore acquire some degree of moral status at that time. If one assumes that having a lesser moral status entails a strong presumption against killing that is not outweighed by considerations of the common good, then extending or lifting the 14-day limit would be morally impermissible. Research before that point could however be permissible. On the other hand, if having a lesser moral status involves a presumption against killing that is overridden by actions that maximize the common good, then extending or lifting the 14-day limit could be morally permissible. Whether it is permissible or not would again depend on the good that we can obtain with human embryo research, such as the significance of the knowledge that we can acquire or the likelihood that such knowledge can result in life-saving treatments. Similarly, if a lesser degree of moral status involves only a weak presumption against destroying embryos, then extending or lifting the 14-day rule could be morally permissible.

The fact that embryos have some moral status could, but need not, affect discussions regarding the moral relevance of embryos' provenance (Table 2). Perhaps having some degree of moral status creates a strong reason against intentionally creating embryos one plans to destroy, but very weak reasons to maintain them alive indefinitely (Warnock 1984). In this case, if embryos have some degree of moral status, then their creation for research purposes would be either morally impermissible or worse than the destruction of embryos left over from IVF.

No Moral Status and the Extension of the 14-Day Guideline

Some supporters of human embryo research at any stage of development believe that embryos do not have even partial moral status (Tooley 1972; Harris 1990; Steinbock 1994; Douglas and Savulescu 2009). They claim that embryos lack any of the characteristics that plausibly confer moral status, such as sentience or certain cognitive or emotional capacities.

The claim that embryos lack moral status can affect the possibility of extending or lifting the 14-day limit. Insofar as embryos lack the characteristics that confer moral status at any stage of development, then the 14-day limit would be of little significance on these grounds. To the extent that possession of moral status is thought to be the most relevant consideration against embryo experimentation, extension of the 14-day rule would be morally permissible. Indeed, if research on human embryos after 14 dpf is likely to bring significant benefits to human beings—and other entities with full or partial moral status—some commentators believe that such research is not only morally permissible but morally obligatory (Harris 2006).

Nonetheless, even if embryos lacked moral status, this does not mean that they have no moral value at all. Lacking moral status means that the embryo's interests—if they have any—do not matter for their own sake. But it does not follow that one can do with

embryos as one pleases. We might still have obligations to not destroy embryos because they matter to others who do have full moral status (Annas et al. 1996). For example, they can matter to the gamete providers. Similarly, we might have obligations to embryos even if they lack moral status because they have some symbolic value that humans have an interest in promoting. For instance, they might remind us of the way we all were created, or they are valuable because they have the capacity to become human beings. Such symbolic value would give us some reasons to act in particular ways towards embryos, for example to use them only in worthy activities rather than frivolous ones (Steinbock 1996).

What might override these different reasons regarding embryos' value is however not answered by the issue of the embryos' lack of moral status. Instead other substantive normative considerations, such as the relevance of the knowledge to be acquired or the benefits that can be derived from such knowledge, would play a role. Moreover, if embryos lack moral status or even moral value, it does not mean that research with embryos is necessarily morally permissible. One should not assume that an embryo's moral status is the only relevant moral consideration.

Most of the ethical discussion regarding embryo experimentation and the extension of the 14-day limit has focused on the moral status of the embryo. However there are other relevant issues. For example, we might care about the health of the women who are the source of the ova necessary to create embryos. Concerns about women's health are particularly salient when embryos are created explicitly for research purposes rather than for their own reproductive projects. Ova donors must undergo hormonal injections, regular visits to doctors, and a non-trivial surgical procedure. The drugs and medical interventions involve various risks, some of them serious.

Ethical concerns about compensation to egg providers and the possibility of exploiting women of lower socioeconomic status can also be relevant to conclusions about the extension of the 14-day limit, above and beyond, or perhaps instead of, considerations of embryos' moral status. If one believes that the creation of embryos can be harmful to women's health and that it can contribute to exploitative practices, these can be reasons against human embryo research even if embryos lack moral status or moral value. Similarly, if extending or lifting the 14-day limit were to lead to a need for more embryos, concerns about women's health or about whether they might be exploited could also count as reasons against such extension. How strong these reasons are and what can override them would be a matter of other normative claims. For instance, one might argue that although risks to women's health count as a reason against extending or lifting the 14-day limit, women can make autonomous decisions about those risks. Likewise, if concerns about exploitation were to count as a reason against research on human embryos beyond 14 dpf, policies could be adopted to minimize exploitative practices.

An embryo's lack of moral status might have relevance to the debate over the embryos' provenance (Table 2). Some might argue that creating embryos for

research purposes is contrary to the value that embryos should be given, perhaps because such intentional creation shows disrespect for the earliest stages of human life (see Robertson 1994 for this argument, though he does not endorse it). However, using embryos left over from IVF treatments could be consistent with such value, particularly when the embryos would otherwise be discarded or left frozen indefinitely rather than put to use in other reproductive projects.

It could also be that the fact that embryos lack moral status makes their provenance irrelevant to the moral evaluation of actions involving them. As entities without moral status, the main consideration could simply be the benefits that can be obtained from using them in research. If so, whether embryos are created explicitly for research or are the result of IVF treatments would be of little significance as long as the gamete donors consented to their use (which is a matter of respecting the autonomous wishes of agents with full moral status).

Determining whether or not embryos have full or partial moral status or whether they acquire such status before or after 14 dpf is insufficient by itself for recommendations about the moral permissibility of research on human embryos beyond 14 dpf. Granted, if embryos were thought to have full moral status at any stage of development, we would have a stringent—but not absolute—reason not to destroy them at any stage of development. If they were to acquire a full moral status at 14 dpf, we would have a stringent reason not to extend or lift the 14-day limit. If embryos are entities with a lesser moral status—at any stage of development or acquired at some later post-embryonic developmental state—or with no moral status at all, other considerations would be relevant to the moral permissibility of extending or lifting the 14-day deadline.

Religious Views Associated with the Moral Status of Embryos and the Implications for Human Embryo Research

Understanding the breadth of views regarding the moral status of the human embryo and the permissibility of human embryo research in the United States requires not only a summary of philosophical positions but also a description of religious perspectives. Religion continues to be important in the public and private lives of many people in the United States (Newport 2016). Thus, we offer an overview of how several world religions understand the human embryo and the permissibility of human embryo research. As with the grounds for moral status earlier, our discussion does not aim to be exhaustive. We therefore focus on the five major world religions: Judaism, Islam, Buddhism, Hinduism, and Christianity (including Protestant, Roman Catholic, and Orthodox Christians). While we acknowledge this is a limited review, these religions represent more than three-quarters of the U.S. population (Pew Research Center 2018). For each religion, we note some of the differences among adherents regarding the status of embryos or the permissibility of conducting embryo research. We do not offer a

comprehensive account of each religion, nor do we assess their positions. As is evident below, some of these traditions have given more consideration to the status of embryos than others.

Some scholars have explicitly defended the inclusion of religious perspectives in public discussion (Childress 2017; Guinn 2002). Human embryo research policies, like all other public policies, are developed and implemented in a complex sociopolitical context in which competing, and sometimes incompatible, worldviews exist. Religious views are part of the cultural and political context in the United States and as such are relevant to public bioethics discourse. Demonstrating respect for diverse moral perspectives requires, at the very least, understanding them. For some, including religious scholars in the conversation is important for understanding the range of perspectives in society (Guinn 2002). Indeed, when the U.S. National Bioethics Advisory Commission (NBAC) deliberated on human embryonic stem cell (hESC) research in 1999, it asked for statements from scholars representing a range of religious positions. These statements often included information and religious views on the moral status of the human embryo.

Some observers criticized the NBAC for considering religious perspectives. These objections were grounded in the claim that it is unconstitutional or inappropriate to consider religious arguments in a public context (Lewontin 1997; Pence 1998). Others might have objected on grounds that religious perspectives are “comprehensive world views” (Greenawalt 1985). In these accounts, because such views are not grounded solely in reason and can fail to be accessible to others through reason alone, they are not admissible in public policy discourse.

Others, however, have argued that not just religious but all accounts of morality, including secular ones, rely on a conception of the good that reason alone does not disclose. Therefore, all accounts of morality also constitute comprehensive worldviews (Wildes 2002; Engelhardt 1996). To say anything substantive in bioethics, whether it be about the importance of advancing research or alleviating suffering, the moral status of embryos requires a concept of the good (Groenhout 1998; Cahill 1990; Meilander 2001). We concur with the NBAC’s assessment that decisions about human embryo research should take into account religious perspectives.

Judaism

In Judaism, 40 days of development is a key marker in assessing embryos’ moral status because it is when the soul first becomes present (see Tendler 2000 in Walters 2004; Ron-El and Rizk, 2012). From that point until birth, embryos and fetuses are owed increasingly more respect. At birth, entities become full legal persons (Gordon and Washofsky 2004; Schenker 2008).

Several Jewish scholars who take embryos not to have full moral status in general have nonetheless warned that “even the earliest embryo has potential to develop into human life, mandating caution and thoughtfulness” (Mackler 2004, 151).

Others, such as Jewish bioethicist Laurie Zoloth, argue that conducting research, including research on embryos, that has the potential to heal and to save human lives is not only permissible but encouraged within the Jewish tradition, which recognizes a strong obligation to save life (Zoloth 2000).

Some Jewish scholars distinguish between *in vitro* and *in utero* embryos, while others do not (Mackler 2004). The presumption against destroying embryos and fetuses is that they will become persons (a potentiality consideration). *In vitro* embryos created for IVF that will not be transferred for pregnancy have no such potential, leading some “rabbinical authorities [...] to approve the disposal of excess embryos and, by logical extension, the use of such embryos in medical research” (Gordon and Washofky 2004, 139). It is unclear whether those same authorities would permit the creation of embryos specifically or exclusively for research purposes. Other Jewish scholars argue that “there are no obvious grounds for assuming that nascent human life may be destroyed simply because it is not sheltered in its natural habitat, i.e., its development takes place outside the mother’s womb” (Bleich 1991, 97). It is plausible that as the embryo develops, especially beyond 40 dpf, much stronger justifications in terms of possible life-saving benefits would be required to warrant human embryo research.

Islam

Muslim leaders, both from the Sunni and Shiite sects, have issued different *fatwas*, or religious rulings, addressing the status of embryos and fetuses (Matthews et al. 2013). We find some differences among them. Policies that different Muslim-majority countries have adopted regarding hESC research reflect these differences, though they generally allow research that involves the destruction of early embryos (Flynn and Matthews 2010). Islamic commentators typically treat 40 dpf or 120 dpf as the point after which an embryo or fetus may not be destroyed (Sachedina 2004). In some Islamic writings, even embryos prior to ensoulment have “sanctity” and ordinarily should not be destroyed, though it might be allowed for therapeutic or research purposes (Larijani and Zahedi 2004).

Islamic scholars express uncertainty about possible differences between “surplus” embryos created for reproductive purposes and embryos created for research (Flynn and Matthews 2010). Some argue that “the principles of public good (*maslaha*) that promotes what is beneficial and necessity (*darura*) that overrules prohibition—could provide moral-legal justification for the use of surplus embryos as the source of stem cells for research [and that] the principle of the sanctity of life does not apply to embryos that are outside the womb” (Sachedina 2009, 13). Others argue that “the human embryo is a potential human life [and] has moral-legal status and deserves respect from the time it is conceived [...] Any ruling that permits the creation of human embryos expressing as material for medical research, to be destroyed pell-mell in the process, is an affront to the divine edicts of the Shari’a” (Sachedina 2009). Here, as with Judaism, we find an appeal to the importance of the developing embryo and fetus, “affirming a progressively growing respect to the dignity and rights of the fetus” (Sachedina 2009, 138).

Islam does not “differentiate between pre-implanted embryos and those that are already implanted in the uterine wall. All the laws in the criminology speak only of the *in utero* embryo” (Sachedina 2009, 138). The question remains whether the *in vitro* embryo is morally equivalent to the *in utero* embryo or not.

Buddhism

The literature on Buddhist perspectives does not take embryos to be persons (see, for example, Sivaraman and Noor 2014). Some noted scholars on Buddhism, such as Damien Keown, suggest that embryo destruction could pose concerns for Buddhists because it involves harm and the taking of life (Keown 2004), but not all agree with this assessment (Walters 2004). Some Buddhist scholars specify that pre-implantation embryos have not acquired personhood, such that the use of surplus embryos to promote health poses no concern (Sivaraman and Noor 2014; Neaves 2017; Buchitchon 2012).

Hinduism

In Hinduism, embryos are seen as deserving respect because “most Hindus believe that the beginning of personhood coincides with the occurrence of reincarnation at the moment of conception” (Neaves 2017, 2542; Sivarama and Noor 2014). Despite being protective of embryos and fetuses, the flexibility of Hinduism might allow for embryo destruction under some circumstances (Tiwari 2013; Neaves 2017). Human embryo research that could improve or save human life might be allowed (see Walters 2004). Because of the respect owed to embryos, Hindu scholars generally hold that only surplus embryos created for reproductive purposes may be used and that embryos should not be created specifically for research purposes (Sivaraman and Noor 2014; Neaves 2017).

Christianity

An *ad hoc* report from a group of Christian theologians delivered to the U.K. House of Lords Select Committee on Stem Cell Research in 2001 addressed the place of the embryo in the Christian tradition. The authors included Roman Catholic, Orthodox Christian, and Protestant scholars. They concluded that all Christians historically recognized the impermissibility of intentionally destroying embryos: “Even in the Middle Ages, when most Western Christians held that the early embryo was not yet fully human, it was held that the human embryo should never be attacked deliberately, however extreme the circumstances” (Jones 2001, 191). Sometimes exceptions were granted to save a pregnant woman’s life, but all other direct attacks on the embryo or fetus were forbidden (Jones 2001).

Today, some individuals and groups within the Christian tradition accept embryo destruction at least under some circumstances. Here we summarize some of the major positions held by three main categories of Christians: Roman Catholics, Orthodox Christians, and Protestants (including mainline Protestants and nondenominational Christians, as well as Episcopalians and Anglicans, who sometimes do not identify as Protestants).

Roman Catholicism

At one time, the Roman Catholic Church held that ensoulment occurred at 40 dpf and that destruction of embryos constituted homicide only after that time (Walters 2004). Since 1869, the Roman Catholic Church has forbidden the intentional destruction of embryos at any point in development (Pius IX 1869). Numerous Roman Catholic scholars and lay people reject this position (Farley 2000). Nevertheless, the Roman Catholic Church's prohibition on embryo destruction is clear and absolute. A 1974 document on abortion from the Congregation for the Doctrine of the Faith (the arm of the Roman Catholic Church for teaching and enforcing doctrine) declared that, "from the time that the ovum is fertilized, a new life is begun which is neither that of the father nor of the mother; it is rather the life of a new human being with his own growth. It would not be made human if it were not human already" (CDF 1974, 388). It specifies that "even if a doubt existed whether the fruit of conception is already a human person, it is objectively a grave sin to dare to risk murder" (CDF 1974). The Vatican confirmed this in 1987 in its Instruction on Respect for Human Life (CDF 1987). The papal encyclical *Evangelium Vitae* (John Paul II 1995) also stipulates that new life begins at conception. The 2017 Catechism confirms that a new person comes into existence at fertilization. The intentional destruction of human embryos for research (or any other purpose) is prohibited regardless of the developmental age of the embryo, the intended ends, or the embryo's origin.

Orthodox Christianity

The Orthodox Church's teachings, drawn from scripture, writings of the Church Fathers, and statements from bishops and councils among others, treat the destruction of unborn human life as gravely sinful regardless of whether one considers the embryo or fetus a person, and regardless of its developmental stage. St. Basil the Great, for instance, writing on abortion in Long Rule 188, said that "the woman who purposely destroys her unborn child is guilty of murder. With us there is no nice enquiry as to its being formed or unformed" (St. Basil the Great 1994, 225). The Orthodox Church does not insist that the early embryo is a person; it is irrelevant whether or not the embryo is a person. It must be treated as a person (See Engelhardt 2000, 304). Where a new human life has come into existence, it must be respected as such, and we must not kill it (Engelhardt 2000, 304-305).

Contemporary Orthodox scholar Fr. Demetrios Demopoulos explained the Orthodox Christian view of the embryo to NBAC this way:

Whether created *in situ* or *in vitro*, a zygote [or fertilized egg] is committed to a developmental course that will, with God's grace, ultimately lead to a human person. The embryo and the adult are both potential human persons, although in different stages of development. As a result, Orthodox Christians affirm the sanctity of human life at all stages of development. Unborn human life is entitled to the same protection and the same opportunity to grow in the image and likeness of God as are those already born. (Demopoulos 2000, B-3)

Although some religions distinguish between surplus embryos created for reproductive purposes and those created for research purposes, or between *in utero* and *in vitro* embryos, the Orthodox Church makes no such distinction. The very term ‘surplus embryos’ is problematic since “it cannot be accepted that there are surplus human beings whose fate is determined by third parties. Each human being—and therefore each embryo—possesses the uniqueness of personhood, the sacredness of God’s image, and the need to be in communion with other persons” (Koios 2009, 362).

Protestant Traditions

Among the many Protestant denominations and nondenominational churches that have emerged from them, there are different views about the human embryo’s moral status. Indeed, support can be found among Protestants for everything from an outright ban on human research to the permissibility of it far beyond 14 dpf.

Protestants who reject embryo destructive research often cite biblical sources (Neaves 2017, 2542). These passages include Jeremiah 1:5: “Before I formed you in the womb I knew you, and before you were born, I consecrated you; I appointed you a prophet to the nations,” and Ecclesiastes 11:5: “as you do not know how the spirit comes to the bones in the womb of a woman with child, so you do not know the work of God who makes everything.”

Protestants who support research on human embryos also sometimes invoke biblical passages to support their position. Ronald Cole-Turner points out that the scriptural reference to being “knit [...] in my mother’s womb” describes “a process of formation” rather than a complete organism being present from the beginning (2003, 90). Exodus 21:22-25 distinguishes between different stages of development before birth: “If two men fight and hurt a woman with child, and her child is born imperfectly formed, he shall surely be punished accordingly as the woman’s husband imposes on him; and he shall pay as the judges determine. But if the child is perfectly formed, he shall give life for life, eye for eye, tooth for tooth, hand for hand, foot for foot, burn for burn, wound for wound, stripe for stripe.” Cole-Turner concludes that:

We must perform our moral assessment of human development in view of the reality of our gradual development. There is no clear and clean developmental break point or bright line occurring between human conception and birth. Nevertheless, we can see that the embryo is *not* a child, that something profound and momentous occurs along that precarious but gradual pathway to life. (2003, 90)

In addition to supporting human embryo research in general, Cole-Turner suggests that there is no reason to think that Protestant support for it would be limited to embryos younger than 14 dpf: “the line drawn at fourteen days after fertilization is nothing more than a line that is drawn on nature, not one that is found in nature” (2003, 90).

Several documents from various Protestant Christian denominations conclude that human embryos should not be destroyed. The Lambeth Conference, a meeting

of Anglican bishops, stated in its 1958 'The Family in Contemporary Society' that "the killing of a life already conceived" is prohibited (1958, 17). The Southern Baptist Convention issued 'Resolution: On Human Embryonic and Stem Cell Research' in 1999, in which they reaffirmed their "vigorous opposition to the destruction of innocent human life, including the destruction of human embryos" (Southern Baptist Convention 1999). This resolution was issued in the context of debates over hESC research but applies to the other forms of human embryo research under discussion.

When addressing the NBAC, Christian ethicist Gilbert Meilaender noted that there is no single Protestant view. In arguing against the intentional destruction of human embryos, he said: "The embryo is [...] the weakest and least advantaged of our fellow human beings, and no community is really strong if it will not carry its weakest members" (NBAC 2000, E-3, referring to Barth 1961).⁷ Meilaender rejects the person/human being distinction and argues that being a person does not require that we have certain capacities. He also acknowledges the possible good that could come from research involving the destruction of embryos, but he notes that sometimes we must "deny ourselves the handiest means to an undeniably good end" (NBAC 2000, E-4).

While some Protestant scholars and churches hold that destroying human embryos is impermissible, others have advocated for hESC research, which involves the destruction of human embryos. When addressing the NBAC on hESC research, Cole-Turner (2000) noted that the United Church of Christ had no official position on the destruction of embryos in research or the moral status of embryos. Some people in the church would agree that embryos are persons and many would not, "believing instead that embryos have an important but lesser status" and that "given certain conditions," human embryo research is permissible and even something to encourage and fund because of the potential benefits (Cole-Turner 2000, A-3). The United Church of Christ issued a statement in support of hESC research in 2001 (United Church of Christ 2003).

Other Protestant groups that maintain that research on human embryos is permissible at least under some circumstances include the U.S. Presbyterian Church. Its 2001 statement on hESC research reveals the view that embryos "have the potential of personhood, and as such they deserve respect" and should be used only in research that is "compelling and unreachable by other means." Where research on embryos might lead to "lifesaving breakthroughs in major diseases," it is wrong to prohibit such research: "Prohibition of the derivation of stem cells from embryos would elevate the showing of respect to human embryos above that of helping persons whose pain and suffering might be alleviated." The same reasoning likely would apply to other embryo-destructive research.

⁷ Karl Barth, a well-known Calvinist theologian of the 20th Century, wrote that "no community, whether family, village or state, is really strong if it will not carry its weak and even its very weakest members" (1961, 424).

The Call for a New Policy Compromise

The language of pragmatic compromise plays an important role in public policy. Policies that only partially satisfy groups that hold competing positions are adopted in order to move forward in the face of irresolvable differences (Master and Crozier 2012). Parties that are unwilling to compromise might be characterized as bad actors. The current request to extend or lift the 14-day limit on human embryo research may be characterized as an invitation to opponents and proponents of it to revisit what some see as an outdated compromise.

But in an important sense, the 14-day limit was not a compromise at all. Compromise involves all parties making concessions. At the time the 14-day limit was adopted by various bodies in the United Kingdom, United States, and elsewhere, it was not technically possible to do research on embryos close to 14 dpf, let alone more than 14 dpf. When we look at the trade-offs that the 14-day deadline involved, we see that it did not limit researchers in any way. Any limits were imposed by technology, and thus human embryo research advocates lost nothing in agreeing to a 14-day limit. In this sense, adopting the 14-day limit involved a compromise only for those who opposed all research on embryos. They conceded what they wanted, which was to prohibit the destruction of human embryos. Only now that the technological barrier to prolonged human embryo research has been removed would the 14-day limit be appropriately characterized as a compromise on the destruction of human embryos that required both proponents and opponents of it to give up something important to accommodate a competing view.⁸

As we consider the possible expansion of research on human embryos beyond 14 dpf, it will be important to consider competing accounts of the moral status of the embryo, reasons for and against embryo destructive research, the conditions that might or might not justify such research, and the trade-offs different policy approaches entail. Scholars have argued that attending to such considerations is a condition of performing science in societies, especially democratic ones:

Facile references to politics ‘standing in the way of good science’ [...] denigrate the foundations of science and democracy alike. Science depends on a space in which it can observe its internal norms and exercise its specialized skills, but in a way that coheres with, rather than contradicts, the norms and aspirations of the democratic societies in which science is embedded. (Hurlbut and Robert 2012a, 712)

Potentially dramatic improvements in human health outcomes resulting from certain types of research (e.g., hESC research, invasive experimentation with chimpanzees, research on embryos 32 dpf) are not by themselves sufficient to warrant that

⁸ For others, however, a compromise did occur: a compromise between those who thought science should be autonomous and those who defended external constraints on scientific inquiry. Insofar as the 14-day limit represented such an external constraint (even if at that point the constraint was primarily a technical one), then the rule represented a compromise.

research. Nor, for that matter, is it a sufficient reason to ban research that will yield no advances in human health outcomes. The policy debates are necessarily complex because the stakes are high and the relevant considerations far ranging:

If science is to be good science—productive, stable, and in the service of the public—it must be coupled with, and inviting of, good politics. If resolutions are achieved through a commitment to reason and transparency, if they invite critical reassessment and revision, if they are open to and respectful of skeptical disagreement, if they acknowledge uncertainty and ignorance, then they will reflect the values—and the forms of humility—that form the bedrocks of science and democracy alike. (Hurlbut and Robert 2012b, 725)

Stakeholders, including scientists, policymakers, and the interested public, must enter into these policy debates about science. They must do so equipped with a sound understanding of the science, ethics, and policy landscapes, and they must be prepared to do the hard work of negotiating a solution or solutions that represent us best as a society.

References

- Aach, John, Jeantine Lunshof, Eswar Iyer, and George M. Church. 2017. “Addressing the ethical issues raised by synthetic human entities with embryo-like features.” *eLife* 6: e20674. <https://elifesciences.org/articles/20674>.
- Annas, George J. 1989. "At Law: A French Homunculus in a Tennessee Court." *The Hastings Center Report* 19 (6): 20–22.
- Annas, George J., Arthur Caplan, and Sherman Elias. 1996. “The politics of human-embryo research— avoiding ethical gridlock.” *New England Journal of Medicine* 334 (20): 1329–1332.
- Barth, Karl. 1961. *Church Dogmatics*. Vol. III, part 4. Edinburgh: T. & T. Clark.
- St. Basil the Great. 1994. “Letter 188.” In *Nicene and Post-Nicene Fathers*, edited by P. Schaff and H. Wace, 223–228. Second series, vol. VIII. Peabody, MA: Hendrickson Publishers.
- Baylis, Francoise, and Timothy Krahn. 2009. “The trouble with embryos.” *Science and Technology Studies* 22 (2): 31–54.
- Belliemi, Carlo Valerio. 2012 “Pain assessment in human fetus and infants.” *The AAPS Journal* 14 (3): 456–461.
- Benn, S. 1967. “Egalitarianism and equal consideration of interests.” In *Nomox IX: Equality*, edited by J.R. Pennock and J. Chapman, 61–78. New York: Atherton Press.
- Bijker, Wiebe E., Roland Bal, and Ruud Hendriks. 2009. *The Paradox of Scientific Authority: The Role of Scientific Advice in Democracies*. Cambridge, MA: MIT Press.
- Bleich, J. David. 1991. "In Vitro Fertilization: Questions of Maternal Identity and Conversion." *Tradition: A Journal of Orthodox Jewish Thought* 25 (4): 82–102.
- Bok, Sissela. 1988. "Who Shall Count as a Human Being?" In *What Is a Person?* edited by Michael Goodman, 213–228. Clifton, NJ: Humana Press.

- Buchitchon, Suntaree. 2012. "Buddhism and the Status of the Human Embryo: The Regulation of Human Embryo Research in Thailand." Doctor of Juridical Science diss., La Trobe University.
- Cahill, Lisa. 1990. "Can Theology have a Role in 'Public' Bioethical Discourse?" *Hastings Center Report* 20 (4): 10–14.
- Campbell, Alastair V. 1985. "Viability and the Moral Status of the Fetus." In *Abortion: Medical Progress and Social Implications*, edited by Ruth Porter and Maeve O'Connor, 228–243. John Wiley & Sons, Ltd.
- Childress, James F. 2017. "Reflections on the National Bioethics Advisory Commission and Models of Public Bioethics." *Hastings Center Report* 47 (S1): S20–S23.
- Cole-Turner, Ronald. 2000. "Testimony." In *Ethical Issues in Human Stem Cell Research, Volume III: Religious Perspectives*, National Bioethics Advisory Commission, A-3–A-4. Rockville, MD: NBAC.
- . 2003. "Principles and Politics: Beyond the Impasse over the Embryo." In *God and the Embryo: Religious Voices on Stem Cells and Cloning*, edited by Brent Waters and Ronald Cole-Turner, 88–97. Washington, D.C.: Georgetown University Press.
- CDF (Congregation for the Doctrine of the Faith). 1974. "Declaration on Procured Abortion." http://www.vatican.va/roman_curia/congregations/cfaith/documents/rc_con_cfaith_doc_19741118_declaration-abortion_en.html.
- . 1987. "Donum Vitae." http://www.vatican.va/roman_curia/congregations/cfaith/documents/rc_con_cfaith_doc_19870222_respect-for-human-life_en.html.
- Curzer, H. 2004. "The Ethics of Embryonic Stem Cell Research," *Journal of Medicine and Philosophy* 29 (5): 533–562.
- DeGrazia, D. 1996. *Taking Animals Seriously: Mental Life and Moral Status*. Cambridge: Cambridge University Press.
- . 2008. "Moral Status As a Matter of Degree?" *Southern Journal of Philosophy* 46: 181–198.
- Demopoulos, Demetrios. 2000. "Testimony." In *Ethical Issues in Human Stem Cell Research, Volume III: Religious Perspectives*, National Bioethics Advisory Commission, B-3–B-4. Rockville, MD: NBAC.
- Devine, Phillip E. 1978. *The Ethics of Homicide*. Ithaca, NY: Cornell University Press.
- Douglas, Heather. 2009. *Science, Policy, and the Value-Free Ideal*. Pittsburgh: University of Pittsburgh Press.
- Douglas, Thomas, and Julian Savulescu. 2009. "Destroying Unwanted Embryos in Research: Talking Point on Morality and Human Embryo Research." *EMBO Reports* 10 (4): 307–312.
- Dworkin, Ronald. 1973. *Life's Dominion: An Argument about Abortion, Euthanasia, and Individual Freedom*. New York: Alfred A. Knopf.
- Engelhardt, H. Tristram, Jr. 1996. *The Foundations of Bioethics, 2nd ed.* Oxford: Oxford University Press.
- . 2000. *The Foundations of Christian Bioethics*. Lisse, The Netherlands: Swets and Zeitlinger.

- Epistle of Barnabas*. Translated by J.B. Lightfoot.
<http://www.earlychristianwritings.com/text/barnabas-lightfoot.html>.
- Farley, Margaret A. 2000. "Testimony." In *Ethical Issues in Human Stem Cell Research, Volume III: Religious Perspectives*, National Bioethics Advisory Commission, D-3–D-4. Rockville, MD: NBAC.
- Feinberg, J. 1980. "Abortion." In *Matters of Life and Death*, edited by T. Regan, 183–217. Philadelphia: Temple University Press.
- Flynn, Jesse M., and Kirstin R.W. Matthews. 2010. "Stem Cell Research in the Greater Middle East: The Importance of Establishing Policy and Ethics Interoperability to Foster International Collaborations." *Stem Cell Reviews and Reports* 6 (2): 143–150.
- Ford, Norman M. 1989. *When Did I Begin? Conception of the Human Individual in History, Philosophy and Science*. Cambridge: Cambridge University Press.
- George, Robert P., and Alfonso Gómez-Lobo. 2005. "The Moral Status of the Human Embryo." *Perspectives in Biology and Medicine* 48 (2): 201–210.
- George, Robert P., and Christopher Tollefsen. 2011. *Embryo: A Defense of Human Life*. Princeton, NJ: The Witherspoon Institute.
- Giubilini, Alberto, and Francesca Minerva. 2012. "After-birth Abortion: Why Should the Baby Live?" *Journal of Medical Ethics* 39 (5): 261–263.
- Gordon, Harvey L., and Mark Washofsky. 2004. "Jewish Bioethics." In *Religious Perspectives on Bioethics*, edited by John Peppin, Mark J. Cherry, and Ana Iltis, 131–146. Leiden, The Netherlands: Taylor & Francis.
- Green, Ronald M. 2001. *The Human Embryo Research Debates: Bioethics in the Vortex of Controversy*. New York: Oxford University Press.
- Greenawalt, Kent. 1985. "The Limits of Rationality and the Place of Religious Conviction: Protecting Animals and the Environment." *William & Mary Law Review* 27 (5): 1011–1065.
- Groenhout, Ruth. 1998. "Care Theory and the Ideal of Neutrality in Public Moral Discourse." *The Journal of Medicine and Philosophy* 23 (2): 170–189.
- Guinn, David E. 2002. "Religion in Public Bioethics: A Necessary Player." *Second Opinion* 9: 15–35.
- Haraway, Donna. 1990. "A manifesto for cyborgs. Science, technology and socialist feminism in the 1980s." In *Feminism, postmodernism*, edited by L. Nicholson, 190–233. New York: Routledge.
- Harris, John. 1990 "Embryos and Hedgehogs: On the Moral Status of the Embryo." In *Experiments on Embryos*, edited by Anthony Dyson and John Harris, 52–64. London: Routledge.
- . 2006. *The Value of Life: An Introduction to Medical Ethics*. London: Routledge.
- Hurlbut, J. Benjamin. 2017. *Experiments in Democracy: Human Embryo Research and the Politics of Bioethics*. New York: Columbia University Press.
- Hurlbut, J. Benjamin, and Jason Scott Robert. 2012a. "Stem Cells, Science, and Public Reasoning." *Journal of Policy Analysis and Management* 31 (3): 707–714.
- . 2012b. "Good Governance Connects Science and Society." *Journal of Policy Analysis and Management* 31 (3): 722–726.

- Hurlbut, J. Benjamin, et al. 2017. "Revisiting the Warnock Rule." *Nature Biotechnology* 35 (11): 1029–1042.
- Hyun, Insoo, Amy Wilkerson, and Josephine Johnston. 2016. "Embryology Policy: Revisit the 14-day Rule." *Nature* 533 (7602): 169–171.
- Irwin, Alan, and Brian Wynne, eds. 2003. *Misunderstanding Science? The Public Reconstruction of Science and Technology*. Cambridge: Cambridge University Press.
- Jasanoff, Sheila. 2005. *Designs on nature. Science and democracy in Europe and the United States*. Princeton, NJ: Princeton University Press.
- Jasanoff, Sheila, ed. 2004. *States of Knowledge: The Co-Production of Science and the Social Order*. New York: Routledge.
- Jaworska, Agnieszka. 2007. "Caring and Full Moral Standing." *Ethics* 117: 460–497.
- John Paul II. 1995. "Evangelium Vitae." http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_25031995_evangelium-vitae.html
- Jones, David. 2001. "A Theologian's Brief: On the Place of the Human Embryo Within the Christian Tradition and the Theological Principles for Evaluating Its Moral Status." *Ethics and Medicine* 17 (3): 143–153.
- Kamm, Frances. 2007. *Intricate Ethics: Rights, Responsibilities, and Permissible Harm*. New York: Oxford University Press.
- Kant, Immanuel. (1998) 1785. *Groundwork of the Metaphysics of Morals*. Trans. and ed. M. Gregor. Cambridge: Cambridge University Press.
- Khushf, George. 1997. "Embryo Research: The Ethical Geography of the Debate." *The Journal of Medicine and Philosophy* 22 (5): 495–519.
- King, Patricia. 1997. "Embryo Research: The Challenge for Public Policy." *Journal of Medicine and Philosophy* 22 (5): 441–455.
- Kitcher, Philip. 2001. *Science, Truth, and Democracy*. New York: Oxford University Press.
- . 2011. *Science in a Democratic Society*. Amherst, NY: Prometheus Books.
- Koios, Nikolaos. 2009. "Embryo and Foetus as Seen by Orthodox Church." *Periodicum Biologorum* 111 (3): 359–363.
- Keown, Damien. 2004. "Buddhism and Bioethics." In *Religious Perspectives on Bioethics*, edited by John Peppin, Mark J. Cherry, and Ana Iltis, 173–188. Leiden, The Netherlands: Taylor & Francis.
- Kuhse, Helga, and Peter Singer. 1982. "The Moral Status of the Embryo." In *Test-Tube Babies*, edited by William Walters and Peter Singer, 57–64. Melbourne: Oxford University Press.
- . 1985. *Should the Baby Live? The Problem of Handicapped Infants*. Oxford: Oxford University Press.
- Lambeth Conference. 1958. "The Family in Contemporary Society." In *What the Bishops Have Said About Marriage*, 17. London: Society for Promoting Christian Knowledge.
- Larijani, Bagher, and Farzaneh Zahedi. 2004 "Islamic Perspective on Human Cloning and Stem Cell Research." *Transplantation Proceedings* 36 (10): 3188–3189.
- Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press.

- Lewontin, Richard C. 1997. "The Confusion Over Cloning." *The New York Review of Books* 44 (16): 20–23.
- Little, Margaret Olivia. 2008. "Abortion and the Margins of Personhood." *Rutgers Law Journal* 39: 331–348.
- Longino, Helen E. 2002. *The Fate of Knowledge*. Princeton, NJ: Princeton University Press.
- Mackler, Aaron L. 2004. "Jewish Perspectives on Embryo and Stem Cell Research." In *Religious Perspectives on Bioethics*, edited by John Peppin, Mark J. Cherry, and Ana Iltis, 147–152. Leiden, The Netherlands: Taylor & Francis.
- Maienschein, Jane. 2014. *Embryos Under the Microscope*. Cambridge, MA: Harvard University Press.
- Marshall, John. 1990. "The Case Against Experimentation." In *Experiments on Embryos*, edited by Anthony Dyson and John Harris, 55–64. New York: Routledge.
- Master, Zubin, and G.K.D. Crozier. 2012. "The Ethics of Moral Compromise for Stem Cell Research Policy." *Health Care Analysis* 20: 50–65.
- Matthews, Kirstin R.W., and Nuria Gallego Marquez. 2019. *The Warnock Report and International Human Embryo Research Policies*. Houston: Rice University's Baker Institute for Public Policy. <https://www.bakerinstitute.org/media/files/files/8a0b4eac/chb-pub-greenwall-intl-012219.pdf>.
- Matthews, Kirstin R.W., and Erin H. Yang. 2019. *Politics and Policies Guiding Human Embryo Research in the United States*. Houston: Rice University's Baker Institute for Public Policy. <https://www.bakerinstitute.org/media/files/files/a9096889/chb-pub-greenwall-hesc-011519.pdf>.
- Matthews, Kirstin R.W., Maude Rowland Cuchiara, Jingyuan Luo, Abdelali Haoudi, and Ayman Bassil. 2013. "International Stem Cell Science and Policy." Baker Institute Policy Report No. 56. <https://www.bakerinstitute.org/media/files/Research/99c5da8a/ST-pub-PolicyReport56.pdf>.
- McMahan, Jeff. 2002. *The Ethics of Killing: Problems at the Margins of Life*, Oxford: Oxford University Press.
- McCormick, Richard A. 1991. "Who or What is the Preembryo?" *Kennedy Institute of Ethics Journal* 1: 1–15.
- Meilaender, Gilbert C. 2000. "Testimony." In *Ethical Issues in Human Stem Cell Research, Volume III: Religious Perspectives*, National Bioethics Advisory Commission, E-3–E-6. Rockville, MD: NBAC.
- Morowitz, Harold J., and James S. Trefil. 1992. *The Facts of Life: Science and the Abortion Controversy*. New York: Oxford University Press.
- Neaves, William. 2017. "The Status of the Human Embryo in Various Religions." *Development* 144 (14): 2541–2543.
- Newport, Frank. 2016. "Five Key Findings on Religion in the U.S." *Gallup*, December 23, 2016. <http://news.gallup.com/poll/200186/five-key-findings-religion.aspx>.
- Pence, Gregory E. 1998. *Who's Afraid of Cloning?* Lanham, MD: Rowman and Littlefield.
- Pew Research Center. 2018. "Religious Landscape Study." <http://www.pewforum.org/religious-landscape-study/>.

- Pielke Jr., Roger. 2007. *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge: Cambridge University Press, 2007.
- . 2012. "Basic research' as a political symbol." *Minerva* 50 (3): 339–361.
- Pius IX. 1869. *Apostolicae Sedis Moderationi*. Decree of October 12, 1869.
- Porter, Jean. 1995. "Individuality, Personal Identity, and the Moral Status of the Preembryo: A Response to Mark Johnson." *Theological Studies* 56 (4): 763–770.
- Presbyterian Church USA. 2001. "Overture 01-50. On Adopting a Resolution Enunciating Ethical Guidelines for Fetal Tissue and Stem Cell Research-From the Presbytery of Baltimore. Attachment A: Statement on the Ethical and Moral Implications of Stem Cell and Fetal Tissue Research."
https://www.eurekaalert.org/pub_releases/2001-06/SaRN-Pvif-1406101.php.
- President's Council on Bioethics (U.S.). 2002. *Human cloning and human dignity: the report of the President's Council on Bioethics*. New York: Public Affairs.
- Quinn, Warren. 1984. "Abortion: Identity and Loss." *Philosophy and Public Affairs* 13: 24–54.
- Rachels, J., 1990, *Created From Animals: The Moral Implications of Darwinism*. Oxford: Oxford University Press.
- Robert, Jason Scott. 2006. "The Science and Ethics of Making Part-human Animals in Stem Cell Biology." *FASEB Journal* 20: 838–845.
- . 2008. Nanoscience, Nanoscientists, and Controversy. In *Nanotechnology and Society: Current and Emerging Ethical Issues*, edited by. F. Allhoff and P. Lin, 225–239. New York: Springer.
- . 2009. "Toward a Better Bioethics." *Science and Engineering Ethics* 15: 283–291.
- Robertson, John. 1994. *Children of Choice*. Princeton: Princeton University Press.
- Ron-El, Raphael, and Botros Rizk. 2012. "Religious Perspectives in Human Reproduction." In *Textbook of Assisted Reproductive Techniques*, edited by David K Gardner, Ariel Weissman, Colin M Howles, and Zeev Shoham, 451–456. Boca Raton, FL: CRC Press.
- Sachedina, Abulaziz. 2004. "Islamic Bioethics." In *Religious Perspectives on Bioethics*, edited by John Peppin, Mark J. Cherry, and Ana Iltis, 153–171. Leiden, The Netherlands: Taylor & Francis.
- . 2009. *Islamic Biomedical Ethics: Principles and Application*. New York: Oxford University Press.
- Sadler, T. W. 2005. "Embryology of neural tube development." *American Journal of Medical Genetics Part C: Seminars in Medical Genetics* 135 (1): 2–8.
- Sandel, Michael J. 2005. "The Ethical Implications of Human Cloning." *Perspectives in Biology and Medicine* 48 (2): 241–247.
- Schenker, Joseph G. 2008. "The Beginning of Human Life." *Journal of Assisted Reproduction and Genetics* 25 (6): 271–276.
- Shapin, Steven. 2010. *Never pure. Historical studies of science as if it was produced by people with bodies, situated in time, space, culture, and society, and struggling for credibility and authority*. Baltimore: Johns Hopkins Press.

- Singer, Peter. 1974. "All Animals Are Equal," *Philosophic Exchange* 5 (1): 103–116.
- . 1993. *Practical Ethics*. Cambridge: Cambridge University Press, 2nd edition.
- Sivaraman, Mathana Amaris Fiona, and Siti Nurani Mohd Noor. 2014. "Ethics of Embryonic Stem Cell Research According to Buddhist, Hindu, Catholic, and Islamic Religions: Perspective from Malaysia." *Asian Biomedicine* 8 (1): 43–52.
- Southern Baptist Convention. 1999. "Resolution: On Human Embryonic Stem Cell Research." <http://www.sbc.net/resolutions/620>.
- Steinbock, Bonnie. 1994. "Ethical Issues in Human Embryo Research." In *U.S. National Institutes of Health. Human Embryo Research Panel (Ad Hoc Group of Consultants to the Advisory Committee to the Director, NIH)*. Report, Volume II: Papers Commissioned for the Human Embryo Research Panel, 27–50. Bethesda, MD: U.S. National Institutes of Health.
- . 2006. "The morality of killing human embryos." *The Journal of Law, Medicine & Ethics* 34 (1): 26–34.
- . 2011. *Life Before Birth: The Moral and Legal Status of Embryos and Fetuses*. New York: Oxford University Press.
- Stokes, Donald. 1997. *Pasteur's Quadrant: Basic Science and Technological Innovation*. Washington, D.C.: Brookings Institution Press.
- Strong, Carson. 1997. "The moral status of preembryos, embryos, fetuses, and infants." *The Journal of Medicine and Philosophy* 22 (5): 457–478.
- Sumner, Leonard Wayne. 1981. *Abortion and Moral Theory*. Princeton: Princeton University Press
- Tauer, Carol A. 1997. "Embryo Research and Public Policy: A Philosopher's Appraisal." *The Journal of Medicine and Philosophy* 22 (5): 423–439.
- Tawia, Susan. 1992. "When is the Capacity for Sentience Acquired During Human Fetal Development?" *Journal of Maternal-Fetal Medicine* 1 (3): 153–165.
- Tendler, Moshe David. 2000. "Testimony." In *Ethical Issues in Human Stem Cell Research, Volume III: Religious Perspectives*, National Bioethics Advisory Commission, H-3–H-5. Rockville, MD: NBAC.
- Tiwari, Shashank Shekhar. 2013. "The Ethics and Governance of Stem Cell Clinical Research in India." Ph.D. diss., University of Nottingham.
- Tooley, Michael. 1972. "Abortion and Infanticide." *Philosophy & Public Affairs* 2 (1): 37–65.
- . 1976. "Abortion and Infanticide." In *Moral Problems in Medicine*, edited by Samuel Gorovitz, Andrew Jameton, Ruth Macklin, John O'Connor, Eugen Perrin, Beverly Page St. Claire, and Susan Sherwin, 297–317. Englewood Cliffs, NJ: Prentice-Hall.
- United Church of Christ. 2003. "Support for Federally Funded Research on Embryonic Stem Cells." In *God and the Embryo*, edited by Brent Waters and Ronald Cole-Turner, 181–184. Washington, D.C.: Georgetown University Press.
- U.S. DHEW (United States Department of Health, Education, and Welfare Ethics Advisory Board). 1979. *Report and Conclusions: HEW Support of Research Involving Human in vitro Fertilization and Embryo Transfer*. Washington, D.C.: U.S. Government Office of Printing.

- U.S. NIH (United States National Institutes of Health). 1994. *Report of the Human Embryo Research Panel*. Bethesda, MD: National Institutes of Health.
- Van de Velde, M., J. Jani, F. De Buck, and J. Deprest. 2006. "Fetal pain perception and pain management." *Seminars in Fetal and Neonatal Medicine* 11 (4): 232–236.
- Walters, LeRoy. 2004. "Human Embryonic Stem Cell Research: An Intercultural Perspective." *Kennedy Institute of Ethics Journal* 14 (1): 3–38.
- Warnock, Mary. 1984. "Report of the Committee of Inquiry into Human Fertilisation and Embryology." London: Her Majesty's Stationery Office.
- Warren, Mary Anne. 1993. "The Personhood Argument in Favor of Abortion." *Life and Death: A Reader in Moral Problems*, edited by Louis Pojman, 304–312. Wadsworth Publishing.
- . 1997. *Moral Status: Obligations to Persons and Other Living Things*. Oxford: Oxford University Press.
- Wildes, Kevin William. 2002. "Bioethics as Social Philosophy." *Social Philosophy and Policy* 19 (2): 113–125.
- Zoloth, Laurie. 2000. "Testimony." In *Ethical Issues in Human Stem Cell Research, Volume III: Religious Perspectives*, National Bioethics Advisory Commission, J-3–J-4. Rockville, MD: NBAC.