

CONNECTICUT LAW REVIEW

VOLUME 37

FALL 2004

NUMBER 1

What Is an Embryo?: A Rejoinder

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*“Do you see this egg? With this you can overthrow all the schools of the-
ology, all the churches of the earth.”*

—Denis Diderot, 1769¹

I. OVERVIEW AND STATEMENT OF THE PROBLEM

As hoped, the Commentary *What Is an Embryo?* stimulated a thoughtful, opinionated, lively debate among the eight attorneys, law professors, scientists, priests and bioethicists who prepared Responses to the commentary.² This is as it should be. Matters of life and death are the core of humankind; respect for freedom and individual values are the core of democracy. Open debate is the fundamental tool to protect freedom and the rights of each individual in democratic societies.

Collectively, the Commentary and the Responses provide a compre-

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¹ Conversation Between D’Alembert and Diderot, in DIDEROT, INTERPRETER OF NATURE 57 (Jonathan Kemp ed., 2d ed. 1963).

² Ann A. Kiessling, *What Is an Embryo?*, 36 CONN. L. REV. 1051 (2004).

hensive, up-to-date compilation of relevant biology, national and international laws, and ethical issues and viewpoints surrounding research on human embryos and activated eggs. The Responders do not agree with each other, and some resist the premise that new vocabulary will clarify the biological, and by inference, the ethical, problems currently hindering research on pluripotent stem cells. The capabilities of the human egg are the fulcrum of the debates. Those capabilities call into question the very essence of humankind, and pressure societies to grapple with the ethical issues about the new tasks assigned to human eggs by new technologies.

As stated in the Commentary, the goal was not to try to re-define existing moral and ethical views of tasks undertaken by eggs, especially “when life begins,” but to try to make room in those views for the new, emerging biomedical technologies that are currently dependent upon the innate capabilities of human eggs.³ Accomplishing this goal requires increased understanding of the biology involved, by parties on all sides of the debate, including the development of an appropriate lexicon for the new technologies. The Commentary featured: (1) a description of the biology of eggs as we know it, including the innate physiological signals emanated by a developing embryo; (2) a review of the highly variable and inconsistent definitions of “embryo” found in dictionaries, statutes, textbooks, and government panel reports; and (3) recommendations for improved accuracy in the terminology used to describe the multiple feats of eggs.

The biology presented in the Commentary highlighted the demands nature places on an egg fertilized by sperm to signal its presence; only those fertilized eggs that signal they are proceeding normally through the early stages of embryogenesis are recognized as embryos by the maternal ovary. Without precise signals from a healthy embryo, the ovary begins to prepare a new egg for a new attempt at a successful baby, and the failed attempt is shed, unmourned, with the next menstrual cycle.

Given nature’s clear definition of an embryo, do religions, bioethicists, scientists, or legislators need to create alternate definitions of when a new life begins? Or how precious is a fertilized egg? There seems no need for any sector of society to impose new interpretations on processes that nature has painstakingly defined and redefined for millions of years. The chemical signals produced by an embryo clearly distinguish it from a fertilized egg, and nature has no tolerance for a fertilized egg that fails to develop into an embryo. Nature has, thus, clearly provided an accurate framework for when a new life begins.

Not only have scientists failed to clarify that these natural processes exist, but methods have not been developed to reliably determine which eggs fertilized in the laboratory are developing into an embryo. Moreover, scientists have failed to fully explain the new technologies that enlist the

³ *Id.* at 1054.

power of eggs to remodel the controls on gene expression. The pattern of expression of individual genes determines the nature and potential of all cells. Components of egg cytoplasm can switch the read-out of the genes needed for a specialized cell (e.g., a skin cell) to the read-out needed for cells with the potential to become many types of specialized cells, similar to embryonic cells. Presumably, these components are the same as those used to remodel the read-out of sperm genes, from generating mature sperm to generating an embryo. By itself, this capability of an egg does not lead inexorably to the decision that everything an egg can do embodies embryogenesis. Nor that simply because the egg's task has the potential, however remote, to give rise to a new offspring, that task should necessarily be revered as a potential new human life.

Elevation to embryo status of egg activities seems especially inaccurate in the case of parthenotes. Eggs can naturally activate spontaneously, begin cell division, and give rise to a few stem cells with the capacity to become a wide variety of cell types. Such spontaneously activating eggs are termed parthenotes, from the Greek word for virgin. Naturally occurring in women as dermoid cysts in ovaries, or benign tumors (teratomas), parthenotes do not give rise to offspring, presumably because the human egg needs a second set of genes to orchestrate normal embryonic development, even though alone it can give rise to a variety of adult cell types. Because parthenotes do not give rise to offspring, nature has already defined them as not embryos. Should society impose a new definition as suggested by the U.S. Congress?⁴ If so, for what purpose?

In contrast, the ability of an egg to remodel gene expression in the chromosomes of an adult cell transplanted into it, and then activate, and begin cell division, does require debate about whether or not such a reconstructed egg should be called an embryo. This is an area of biology that has been highly contentious for many years. Because of an erroneous statement published twenty years ago by a well-known scientist: "the cloning of mammals by simple nuclear transfer is biologically impossible,"⁵ animal cloning, and stem cell research, was delayed nearly two decades. The birth of Dolly the sheep changed the field. Now it is clear that at least a few adult cells contain all the genetic information to engender a new individual; what is required is re-programming the read-out of those genes to begin anew. To generate stem cells for each person in need, however, the read-out does not need to be complete enough to guide the development of a new offspring; it needs only to be able to derive the cell types needed. These two requirements are entirely different.

It is unfortunate that stem cells derived from activated eggs

⁴ Balanced Budget Downpayment Act, I, Pub. L. No. 104-99, § 128, 110 Stat. 26, 34 (1996).

⁵ James McGrath & Davor Solter, *Inability of Mouse Blastomere Nuclei Transferred to Enucleated Zygotes to Support Development in Vitro*, 226 SCIENCE 1317, 1319 (1984).

(parthenotes) are caught up in the nation's anguish over experimenting upon—and destroying—human embryos. It is more reasonable that the debate includes eggs with transplanted chromosomes, because such reconstructed eggs have the potential—however small—to develop into offspring. Scientists may be largely to blame for the confusion, but as the Responses to *What Is an Embryo?* illustrate, bioethicists and lawyers have also done little to clarify the issues. Rather, they seem more than willing to expound at length on the social controversy surrounding the legal and moral status of human embryos created by union of sperm and egg. I agree that debates about “when does life begin” are titillating, but those debates must not be allowed to thwart establishing ethically acceptable guidelines for creating pluripotent stem cells for therapeutic purposes.

The goals of this Rejoinder are to highlight areas of consensus and discord between the Commentary and the Responses, and among the Responses themselves. Those views will then be compared with the views expressed in the recent report issued by President Bush's Council on Bioethics.⁶ The hope is to define common ground that no longer requires debate, in order to focus on those areas of contention in need of resolution so the field may move forward. Pluripotent stem cells may hold the promise of revolutionizing medical treatments for half of all Americans today.⁷ Whether or not this is accurate will be determined in the laboratory and at the bedside. Progress should depend on technology breakthroughs, and clear ethical constraints, not on societal barriers that result from misunderstandings.

II. COMMENTS ON THE RESPONSES

A. What Is an Embryo?: A Comment, *by Harold T. Shapiro*⁸

Professor Shapiro expressed appreciation for the thorough presentation of egg biology, including assisted reproductive technologies. He points out that

In particular it has always been true that increases in human-kind's knowledge base have inevitably raised difficult ethical issues. At the very least, decisions had to be made regarding

⁶ THE PRESIDENT'S COUNCIL ON BIOETHICS, MONITORING STEM CELL RESEARCH (2004), available at http://www.bioethics.gov/reports/stemcell/pcbe_final_version_monitoring_stem_cell_research.pdf (last visited Sept. 9, 2004) (on file with the Connecticut Law Review) [hereinafter MONITORING STEM CELL RESEARCH].

⁷ Daniel Perry, *Patients' Voices: The Powerful Sound in the Stem Cell Debate*, 287 SCIENCE 1423, 1423 (2000).

⁸ Former President of the University of Michigan and Princeton University, Vice Chair of President George Bush Senior's Council of Advisors on Science and Technology, and Chair of President Bill Clinton's National Bioethics Advisory Commission. Harold T. Shapiro, *What Is an Embryo?: A Comment*, 36 CONN. L. REV. 1093, 1093 n.* (2004).

the ethical use of this new knowledge base. The impact of such a decision would be more positive for some than for others, and, therefore, there would be losers and gainers in this process.⁹

The concept of who is gaining and who is losing is central to the debate surrounding the ethical uses of eggs to remodel gene expression. It is clearly deemed ethical by society to fertilize an egg with a sperm with the intent of creating a new human being. It is clearly not deemed ethical by most of society to transplant chromosomes from an adult cell into an egg with the intent of creating an exact copy (clone) of an existing human being. Such human cloning is repugnant to many on theoretical grounds, and at the very least irresponsible on scientific grounds because many animal clones have serious physical disabilities. Given that most societies reject human cloning, does it not simply seem logical to enact legislation to prohibit it? And perhaps not elevate an egg reconstructed with chromosomes from an adult to the same social status as an egg fertilized by sperm? Applying specific terms to each of these widely divergent uses of eggs can clarify both the biology and the intention.

As Professor Shapiro notes:

Kiessling provides very useful evidence that addresses the critical role of language not only in the philosophical debate but with respect to the legal issues that are involved. . . . Moreover, the essay not only demonstrates that participants in these debates often miss the opportunity to better inform each other by the careless use of language, but also provides some useful starting points to begin bringing us all to a common vocabulary based on a fuller understanding of the complex biology involved.¹⁰

Whereas he states the Commentary provides some fundamentally useful guidelines for common language, Professor Shapiro notes disappointment that the discussion did not touch on a very fundamental ethical issue, that of whether or not destroying an embryo “is a matter of homicide.”¹¹ He reasons that if embryos have the moral status of a born person, then destroying them is homicide, and the state has a compelling interest in preventing homicide.¹² This provocative observation serves to enhance the urgency of achieving consensus about the definition of an embryo and its moral status.

Professor Shapiro closes his Comment with:

⁹ *Id.* at 1094.

¹⁰ *Id.* at 1095–96.

¹¹ *Id.* at 1097.

¹² *Id.*

In the decades ahead, debates in these areas are certain to continue, but they will be shaped in part by new discoveries on the biomedical frontier as well as the demand for new and more effective therapeutic modalities. All these debates can benefit by paying close attention to Kiessling's article.¹³

B. Causative vs. Beneficial Complicity in the Embryonic Stem Cell Debate, by Professor John A. Robertson¹⁴

Professor Robertson's Response does not, in fact, respond to *What Is an Embryo?* nor make reference to it in any way. Robertson's essay focuses on the moral, ethical and legal dilemmas facing governments being asked to support human embryonic stem cell research, stating that "[t]he main source currently for embryonic stem cells are embryos created by couples undergoing in vitro fertilization ('IVF') who donate unwanted embryos to research."¹⁵

He further comments:

Moral controversy over the use of ES cells arises from the contested moral status of preimplantation human embryos. Persons who believe that these embryos have inherent moral status oppose the destruction of leftover embryos to derive ES cells for research or therapy, even if those embryos will otherwise be discarded. In contrast, persons who view embryos as too rudimentary in development to have inherent moral status accept derivation and use of ES cells when they have been donated to research.¹⁶

Robertson's scholarly, well referenced essay entirely misses the central points in *What Is an Embryo?*, namely that ES cells from "left-over" human embryos are not the most therapeutically valuable. He focuses, instead, on the ethics of utilizing the product, in this case the embryonic stem cell lines President Bush agreed could be used in federally funded research, of an unethical act, in this case the destruction of the embryos to obtain the embryonic stem cell lines. This is his "beneficial" versus "causative" complicity argument, clearly a provocative ethical-legal topic.

Robertson's Response is illustrative of the confusion that scientists have allowed to develop around stem cells for therapeutic purposes. Every point so carefully presented and documented by Robertson is relevant only

¹³ *Id.*

¹⁴ Vinson and Elkins Chair in Law, University of Texas Law School. John A. Robertson, *Causative vs. Beneficial Complicity in the Embryonic Stem Cell Debate*, 36 CONN. L. REV. 1099, 1099 n.* (2004).

¹⁵ *Id.* at 1099–1100.

¹⁶ *Id.* at 1100.

if embryonic stem cells are the sole source of therapeutically valuable cell lines. Scientists knew when they were derived¹⁷ that they represented model systems for research on pluripotent stem cells, and that therapeutically valuable stem cells would be derived from ovasomes¹⁸ or from parthenotes,¹⁹ but this was not clarified for society at large. Hence, the debate has spiraled nearly out of control about the right of a diseased person to claim the life of a potential person. Had the biology been clearer from the outset, it would not be so politicized today.

Robertson provides valuable information about laws governing embryonic stem cell research in Germany, and contrasts those with U.S. laws developed under the Bush administration. In contrast to Great Britain, for example, Germany prohibits all use of embryos in research.²⁰ Critics of President Bush's policy of limited support have bolstered their arguments with declarations that the U.S. will fall behind in this important technology, an argument similarly applied to Germany's laws.²¹

Robertson states:

Normatively, both the Bush and German position assumes that the embryo is a person or moral subject and should not be destroyed for ES cells or any other purpose. However, if persons in the private sector or outside the country have destroyed embryos to obtain embryonic cell lines, both accept that there is no moral objection to using those lines when there is no reasonable basis for thinking that doing so could have led to the destruction of those embryos. Thus both the U.S. restriction on using only cell lines derived before President Bush's August 9, 2001 speech, and Germany's restriction on use of ES cells derived after January 1, 2002, accept a moral distinction between causing and benefiting from another person's moral wrong in deriving ES cells from embryos. In both cases the acceptable cell lines could not have been derived in reliance on the government's policy, for that policy did not exist at the time of derivation nor could have reasonably been anticipated.²²

He continues:

¹⁷ James A. Thomson et al., *Embryonic Stem Cell Lines Derived from Human Blastocysts*, 282 *SCIENCE* 1145, 1145 (1998).

¹⁸ Ann A. Kiessling, *In the Stem Cell Debate, New Concepts Need New Words*, 413 *NATURE* 453, 453 (2001).

¹⁹ Jose B. Cibelli et al., *Parthenogenetic Stem Cells in Nonhuman Primates*, 295 *SCIENCE* 819 (2002).

²⁰ Robertson, *supra* note 14, at 1102.

²¹ *Id.* at 1103.

²² *Id.* at 1103–04.

Opponents of ES cell research assert that the distinction between causing a wrong and profiting from one is specious or disingenuous in this context. But the distinction is real and has moral weight. Moral responsibility for a wrong requires both causation and complicity. One is not morally responsible for an event unless one has caused that event with the intention, knowledge, recklessness, or negligence necessary for moral culpability.

In many instances benefiting from a past wrong will not have caused the prior wrong to occur and thus does not support causative complicity for that wrong. A good example is the current practice of using organs from murder victims in organ transplantation. . . .

This distinction makes transplant of organs from murder victims morally acceptable even though murder is immoral and criminal.²³

This line of discussion touches on the concern opined by Professor Shapiro, that if embryos have the moral status of persons born, then destroying them for any reason is murder.²⁴

It is truly, truly unfortunate that the science of deriving pluripotent stem cells for therapy has become embroiled in the moral and legal ethics of destroying (“murdering?”) existing human embryos when such sources of stem cells are known to not be the therapeutically most valuable.

C. On Classifying the Developing Organism, *by Louis M. Guenin*²⁵

Guenin provides arguments fashioned after the syllogisms learned in classic lessons in St. Thomas Aquinas’ logic, that describing any response of an activated egg as other than the formation of some form of embryo is illogical. Remarkably, he ascribes the term “asexual” to processes that require an egg but not a sperm.²⁶ Since eggs are as “sexual” as sperm, any process involving one or the other is not, by definition, an “asexual” process. The term “asexual” should be strictly reserved for processes that involve only somatic cells, and neither eggs nor sperm, such as regeneration of a plant from a leaf.

Guenin resists new terminology to describe the new tasks being assigned to eggs on the basis that “embryo” and “clone” are already ade-

²³ *Id.* at 1104–05.

²⁴ Shapiro, *supra* note 8, at 1097.

²⁵ Lecturer on Ethics in Science, Harvard Medical School. Louis M. Guenin, *On Classifying the Developing Organism*, 36 CONN. L. REV. 1115, 1115 n.* (2004).

²⁶ *Id.* at 1116.

quately descriptive.²⁷ Moreover, he argues that human embryos from eggs fertilized by sperm may be used for the derivation of therapeutically useful stem cells if they are so donated by the parents.²⁸ He eschews the value of allowing nature's guidelines about embryhood to play a role in society's decisions about embryonic stem cell research on the basis that the "birth probability consideration" should not play a role in such a decision.²⁹ He mistakenly states: "[o]n Kiessling's understanding, embryhood begins with the primitive streak, an axis of organization forming at about day 14."³⁰ This is neither stated, nor implied in the Commentary, which specifically ascribes embryhood as the series of chemical signals that a normal embryo elaborates even before implantation to notify the maternal ovary that a pregnancy is commencing.³¹

Guenin's lengthy discussion is clearly aimed at requiring that all parties involved in stem cell debates not try to side-step difficult issues, such as when life begins or the moral status of a fertilized or activated egg, in order to justify using stem cells for therapies. He intimates that the suggestion of new terms to define the new tasks eggs are being called upon to perform is designed not to clarify, but to obscure, the biology so as to bias society toward the view that stem cell-derived therapies justify the destruction of any and all forms of embryos. Such a suspicious view of science and scientists is justified by our past failures to craft accurate terminology for new processes. We have stretched the term "embryo" to include everything from pea seedlings to unfertilized, activated eggs. Scientists know the difference in developmental potential; non-scientists do not.

Similarly, we have stretched the term "clone" to cover everything from bacteria viruses to cattle; scientists know the difference between jargon and accuracy in this regard; non-scientists do not.

Guenin concludes his discussion:

Hence I conclude that we do not so much need a new concept of embryo as we need cogent arguments about embryos. Going out on a limb to predict which embryos would, if transferred to a uterus, develop into healthy fetuses, and which would not, will yield only an insecure moral defense, especially for research on embryos that are not developmentally compromised. . . . [Further,] on the generosity of those who donate them, rests the permissibility of using donated

²⁷ *Id.* at 1117, 1130.

²⁸ *Id.* at 1119–20.

²⁹ *Id.* at 1116.

³⁰ *Id.* at 1115.

³¹ Kiessling, *supra* note 2, at 1062.

embryos in fulfillment of the duty of mutual aid.³²

Once again, the ethics of using human embryos for stem cell derivation is central to Guenin's argument. He does not distinguish the therapeutically more valuable parthenotes or gene transplants (ovasomes) from fertilized human eggs out of a desire to not side-step any difficult ethical issues about what an embryo is. This striving for high moral ground is certainly laudable, but leads, unfortunately, to biological inaccuracy rather than ethical candor.

D. A Postmodernist Take on the Human Embryo Research Debate, *by Lars Noah*³³

Professor Noah agrees that

It should surprise no one that the word "embryo" lacks a fixed meaning among legal institutions, much less that the confusion only increases when the question gets presented to a wider audience. In fact, the question has received a wide range of answers from research scientists, lawyers and bioethicists, religious leaders, courts, and state legislatures. As this essay will explain, even our federal government cannot settle upon a consistent position on the matter.³⁴

But rather than embrace my intention that the term "embryo" should have a clear biological definition, Noah lumps it immediately within the context of when life begins, as he exemplifies in a quote from the United States Supreme Court:

We need not resolve the difficult question of when life begins. When those trained in the respective disciplines of medicine, philosophy, and theology are unable to arrive at any consensus, the judiciary, at this point in the development of man's knowledge, is not in a position to speculate as to the answer.³⁵

I agree. Strictly biologically speaking, life does not end. Eggs and sperm are not dead when they unite to form a new entity; they are simply different life forms. The theoretical argument of when life begins was specifically and purposefully not part of *What Is an Embryo?*³⁶

Professor Noah presents a lively and interesting discussion of "Medical

³² Guenin, *supra* note 25, at 1131.

³³ Research Foundation Professor of Law, University of Florida. Lars Noah, *A Postmodernist Take on the Human Embryo Research Debate*, 36 CONN. L. REV. 1133, 1133 n.* (2004).

³⁴ *Id.* at 1134–35.

³⁵ *Id.* at 1135–36 (quoting *Roe v. Wade*, 410 U.S. 113, 159–61 (1973)).

³⁶ Kiesslering, *supra* note 2, at 1054.

Terms in Turmoil”³⁷ and adds numerous, relevant references of great value in rounding out the information in the collected essays. He aptly points out:

Academics who argue against the view that life begins at conception sometimes go to great lengths to demonstrate their recognition of the special character of the embryo. . . .

Like it or not, the question has become essentially a political one, and in politics there are no correct answers, only polling data. If sixty percent of likely voters thought that “embryos” (or ova) had the same moral status as an inflamed appendix, then the elected champions of the religious right might change their tune.³⁸

Importantly, Noah points out a confusing oversight in my Commentary:

Indeed, Kiessler never mentions that Congress already has adopted a definition of the term “embryo.” Although her article excerpts language from the appropriations rider that prohibits federal funding of embryo research, she astonishingly fails to make any reference to the definitional clause that immediately follows the funding restriction: “For purposes of this section, the term ‘human embryo or embryos’ includes any organism, not protected as a human subject under 45 CFR 46 as of the date of the enactment of this Act, that is derived by fertilization, parthenogenesis, cloning, or any other means from one or more human gametes or human diploid cells.”³⁹

He is absolutely correct that this should have been included in my discussion because this is the very clause that caused me to embark upon defining “embryo” more accurately. I distinctly remember the first time I read this clause; it was appended to my National Institutes of Health (“NIH”) grant award statement for a project to study HIV disease that had nothing at all to do with embryos. I was truly shocked that parthenogenesis would be lumped into the term “embryo” by our federal government. It is important to point out that this clause does not so much define “embryo” as it defines all the entities included within the section prohibiting funding for research. I retain the hope that an accurate description of “embryo,” arrived at by careful public debate and consensus, will make its way into congressional lexicon, and avoid such funding confusion in the future.

³⁷ Noah, *supra* note 33, at 1137.

³⁸ *Id.* at 1138–39.

³⁹ *Id.* at 1141 (citation omitted).

Professor Noah's additional discussion about subsequent congressional communications on this topic is most helpful.

Of particular value in Noah's essay is his inclusion of the guidelines adopted by the Food and Drug Administration ("FDA") with respect to contraceptives.⁴⁰ Given the poorly understood contraceptive action of intrauterine devices and hormones administered "the morning after," the FDA is clearly operating under a different set of guidelines than other Health and Human Services agencies. This dichotomy in a government struggling to unify responses serves to emphasize the confusion surrounding the biology of human eggs. Overcoming this confusion at all levels is essential to codifying laws and regulations that reflect both the biology and the prevailing values of U.S. society.

Although I greatly appreciate Professor Noah's careful reading and dissection of my Commentary, and his valuable additions to its information base, I take issue with his multiple assertions that "Kiessling's strategy of distinguishing parthenotes and 'ovasomes' from 'embryos' suffers from a number of flaws."⁴¹ First, I have already pointed out that Congress has erred in including both parthenotes and "ovasomes" under the term "embryos" for the reasons already stated; second, providing accurate terms for the new tasks being placed upon eggs is an effort for the scientific community to "get its own house in order,"⁴² not "scientific jargon or a semantic sleight of hand."⁴³ No, accurate terms will not simply add to the "embryological Tower of Babel."⁴⁴

Third, there is no basis for Noah's leap from pluripotent parthenote stem cells to "totipotent cells that could develop into a viable embryo."⁴⁵ This is precisely the inaccurate discourse to which scientists should have long ago responded with accurate descriptions and more careful attention to bioethical debaters.

Fourth, I made it very clear in *What Is an Embryo?* that nature has defined an embryo for centuries,⁴⁶ and the answer is "Yes" to Noah's question "does Kiessling mean to suggest that an implanted but doomed conceptus does not qualify as an 'embryo' after all?"⁴⁷

Fifth, there remains "no reason to transfer a parthenote to a uterus."⁴⁸ This is not, as claimed by Noah, "a non-sequitur"⁴⁹ because as I detailed in

⁴⁰ *Id.* at 1144–47.

⁴¹ *Id.* at 1156.

⁴² *Id.* at 1154.

⁴³ *Id.* at 1157.

⁴⁴ *Id.*

⁴⁵ *Id.*

⁴⁶ Kiessling, *supra* note 2, at 1062.

⁴⁷ Noah, *supra* note 33, at 1157.

⁴⁸ Kiessling, *supra* note 2, at 1089.

⁴⁹ Noah, *supra* note 33, at 1158.

What Is an Embryo? parthenotes are not uncommon in women, but a parthenote offspring has never been reported in humans, or any other mammal.⁵⁰ What would be the purpose in transferring yet one more to a uterus? If there is concern or fear that it might be attempted, it would be an easy matter to make it illegal to do so. The same could be applied to ovasomes.

Sixth, Noah's comment, "[i]f intent defined status in this fashion, then ova fertilized solely for use in stem cell or other research would never qualify as 'embryos' either . . . but that hardly makes the ethical, legal, and social issues magically evaporate,"⁵¹ is entirely unnecessary since I have repeatedly asserted the special moral and ethical status of eggs fertilized by sperm, as well as their lack of utility in stem cell therapy.

Seventh, my answer is "No" to Noah's question:

And what would she call the result of genetic material derived from a pluripotent cell taken from a fertilized ovum at the blastocyst stage that a researcher then transfers into an enucleated donor ovum—is that the same as transferring nuclear material from an adult somatic cell (and, therefore, also labeled as an "ovosome," at least so long as no one intends to implant it)?⁵²

Eighth, my answer is "Not necessarily" to Noah's assertion: "whatever the future potential for deriving pluripotent stem cells from parthenotes and 'ovasomes,' research on fertilized ova will need to continue in the meantime."⁵³

Ninth, I firmly disagree with Noah's assertion:

Those who view life as beginning at conception (whether or not they care to attach the label "embryo" right off the bat)—as well as those who reject this view while embracing an intermediate position of according special respect even to the earliest stages of human embryological development—will find little satisfaction in Kiessling's beguiling terminological solution. Instead of trying to grapple with the core question, she simply argues that stem cells can be derived from things that, "strictly speaking," are not (yet) "embryos."⁵⁴

This assertion carries the club too often brandished by bioethicists that

⁵⁰ Kiessling, *supra* note 2, at 1081.

⁵¹ Noah, *supra* note 33, at 1158.

⁵² *Id.* at 1159.

⁵³ *Id.*

⁵⁴ *Id.*

anything an egg is asked to do should be considered an “embryo.” I have carefully described the many possible natural outcomes of an egg fertilized by sperm and pointed out that such entities will not be useful sources of pluripotent stem cells for therapy. Parthenotes and ovasomes will be useful sources of stem cells and they are not analogous to embryos derived by the unique union of egg and sperm. To assert that they are embryos serves only the purpose of justifying—and continuing—an ethical debate.

Tenth, Noah’s insinuation that my presentation of the biology and possible alternative terminology is simply for the purpose of gaining access to government funding for research⁵⁵ is truly uncalled for. If we are ever to come to any consensus, suspicion of motives must be set aside. If Professor Noah re-reads my commentary, he will discover a profound respect for the product of the union of sperm and egg, and a firm belief that such entities should never be created solely for research, and that they will not, in any event, be a useful source of pluripotent stem cells.

My goal, instead, has been to try to alleviate the potential fears that other activities of eggs, such as parthenotes and ovasomes, are also embryos derived for the purpose of cloning a human. Suspicion of the motives of the scientific community is remarkably high, and perhaps justified by outrageous claims made by a few rogue scientists, so it is important that everyone fully understand the biology and the potential of human eggs. Only then will true progress be made.

Professor Noah’s in depth analysis of my commentary, and his statements of his opinions, questions and suspicions, has provided a welcome opportunity for open debate of these most important issues. I appreciate his candor, and hope that he appreciates mine.

E. The Politics of Embryonic Discourse, *by Kevin P. Quinn, S.J.*⁵⁶

I agree with Professor Quinn’s assertion:

No one would deny that the subtleties of human embryology are neglected in public debate. This alone should compel scientists to choose terms that make scientific sense and to provide clear definitions. Dr. Kiessling has accepted well that challenge. But I also think that Kiessling is up to something else in her essay. She is attempting to reposition science, to gain for it a more influential voice in the heated politics of embryonic discourse.⁵⁷

I agree that my goal in the Commentary is to “reposition science” in

⁵⁵ *Id.* at 1159–60.

⁵⁶ Professor of Law, Georgetown University Law Center. Kevin P. Quinn, *The Politics of Embryonic Discourse*, 36 CONN. L. REV. 1163, 1163 n.* (2004).

⁵⁷ *Id.* at 1163.

the politics of pluripotent stem cell research. Scientists have failed to communicate clearly and precisely, so the debate has fallen to politicians and bioethicists who have been forced to fill in knowledge gaps without the benefit of all the data.

Despite his suspicions, and apparent rejection of my “making a hidden grasp for political advantage,”⁵⁸ Professor Quinn appears open to the three terminological choices I propose for the activities of human eggs: “embryo” to describe the union of egg and sperm, “ovasome” to describe the product of transplanting chromosomes from a somatic cell into an ovoplast, and “parthenote” to describe the product of activating an egg with its own chromosomes.

As he is careful to point out, accepting the terminology as useful descriptors for the origin of each entity is not the same as being willing to simply cast aside the possibility that ovasomes and parthenotes should be afforded the same ethical and moral considerations as embryos.⁵⁹

I view Professor Quinn’s thoughtful willingness to clarify the debate through the use of specific terms as a major step forward. Moreover, he offers: “In fact, the human parthenote may be a *tertium quid*, an organism that can give rise to stem cells but is incapable of maturing beyond an early stage because it is genetically programmed to die early in its development.”⁶⁰ He falls short of wholly embracing this concept, however, stating that “*current* scientific data does not allow us to endorse Kiessling’s view, because it fails to demonstrate conclusively that the human parthenote is not similar to a human ovasome.”⁶¹ His emphasis on *current* indicates his willingness to continue to revisit this issue as new scientific data appears. This openness to continued re-thinking about the biology and moral status of embryos, parthenotes and ovasomes is especially welcome given Professor Quinn’s role in an esteemed Roman Catholic institution.

The goal of *What Is an Embryo?* was to clarify the biology of activated eggs so as to open a dialogue that supported fully informed decisions to be made about their potential.⁶² Quinn’s closing statement “[l]et the dialogue continue”⁶³ bespeaks success.

⁵⁸ *Id.* at 1164.

⁵⁹ *Id.* at 1168.

⁶⁰ *Id.*

⁶¹ *Id.*

⁶² Kiessling, *supra* note 2, at 1054.

⁶³ Quinn, *supra* note 56, at 1169.

F. Developmental Potential as a Criterion for Understanding and Defining Embryos, *by Keith E. Latham & Carmen Sapienza*⁶⁴

Professors Latham and Sapienza eschew the need for new scientific terms to describe the new tasks being asked of eggs. “New technologies require us to expand the historical definition of an embryo to include those cases in which delivery of the embryo’s genetic material is not via sperm and egg (e.g., ‘cloning’ by adult cell nuclear transfer . . .).”⁶⁵ They further assert: “the method by which the genetic material and the ooplasm are brought together to create the embryo does not alter the nature of the final product of that union.”⁶⁶

But they immediately negate their own assertion that new scientific terms are not needed to describe the new tasks of eggs by adding adjectives to their term “embryo”: “The composition of a ‘cloned’ embryo is, fundamentally, the same as that of a ‘normal’ (fertilized ‘in vivo’) embryo.”⁶⁷

They thus substitute adjectives for new terminology. And they then apply multiple adjectives: “[t]he potential for continued development remains the characteristic that distinguishes in vitro produced embryos and cloned embryos from the cells used to create them, just as it distinguishes in vivo fertilized embryos from egg and sperm.”⁶⁸

The ambiguity in that sentence between “in vitro produced embryos” and “in vivo fertilized embryos from egg and sperm” illustrates precisely the urgent need for new terminology to clarify egg tasks even among scientists.

Latham and Sapienza provide a provocative Life Table⁶⁹ of various types of embryos to establish that potential to develop to an offspring should not be used as criterion to be called “embryo.” They point out that embryos created from two sets of sperm chromosomes or two sets of egg chromosomes have “no potential to develop to term but those derived by adult cell nuclear transfer, or cloning . . . , have a small (but non-zero, in non-primate models) chance of surviving to birth.”⁷⁰

It is important to point out that these data, including the observation that adult cell nuclear transfer has not resulted in a single birth from any species of primate, may provide precisely the scientific evidence that Professor Quinn requires to determine that parthenotes, and perhaps ovasomes,

⁶⁴ Professors at Temple University School of Medicine. Keith Latham & Carmen Sapienza, *Developmental Potential as a Criterion for Understanding and Defining Embryos*, 36 CONN. L. REV. 1171, 1171 n.* & n.** (2004).

⁶⁵ *Id.* at 1171.

⁶⁶ *Id.*

⁶⁷ *Id.* at 1171–72.

⁶⁸ *Id.* at 1172.

⁶⁹ *Id.* at 1175.

⁷⁰ *Id.* at 1172.

are, in fact, “a *tertium quid*.”⁷¹

Latham and Sapienza insist that the low probability of an embryo with aberrant numbers of chromosomes surviving to birth proves that even embryos with a zero probability of surviving should still be called embryos.⁷² They do not mention the concept that the zero or low probability of survival is due to a different view held by nature, one that clearly distinguishes ruthlessly between defective fertilized eggs and embryos.

They espouse the view held by most other Responders to the Commentary that because it is not possible to predict with precision which embryos will, and which will not, develop into humans, it is essential to view all with equal respect.

They then make a statement that is negated by their own tabulated data: “There is an absolute and undeniable continuity of life from fertilization to birth. There are no magical milestones along the way to demarcate a ‘non-embryo’ from an ‘embryo.’”⁷³ The birthrates they provide in their table provide ample example of the inaccuracy of this statement.

It is not clear from their arguments why they hold steadfast to applying the single term (with appropriate modifiers) “embryo” to everything an egg does. Their only criterion for “embryo” is an egg with a diploid number of chromosomes. This viewpoint may be the very reason that scientists have not clarified for society the various tasks performed by eggs. These scientists appear to steadfastly believe that chromosome number, not chromosome origin, is all that matters and that eggs have only one function, to give rise to embryos, albeit many types. They do not propose a term for a haploid parthenote, an activated egg with only one set of chromosomes.

Moreover, they hold the view that new terminology to describe the new tasks eggs are being asked to carry out “serves political, not scientific ends.”⁷⁴ It is not clear from their discussion if this is true, given the confusion between in vitro and in vivo derived embryos above, nor why this is not a laudable goal.

Their view that “[t]he use of embryos (whether they be cloned, ‘abnormal,’ or ‘surplus’ embryos from assisted reproduction) to create stem cells must be judged by society after weighing the developmental potential of morphologically simple preimplantation state human embryos against our compassion for persons already living with (and dying from) devastating diseases”⁷⁵ appears in basic agreement with Guenin’s high moral ground view that everything an egg does should be viewed as a potential life form, but that using that potential life form to alleviate suffering of a

⁷¹ Quinn, *supra* note 56, at 1168.

⁷² Latham & Sapienza, *supra* note 64, at 1172–73.

⁷³ *Id.* at 1173.

⁷⁴ *Id.*

⁷⁵ *Id.* at 1174.

real life form should be done “in fulfillment of the duty of mutual aid.”⁷⁶

It is interesting, and informative, that these two senior reproductive scientists eschew new terms to accurately describe new egg tasks. The resistance appears to arise from a reluctance to appear complicit in trying to obfuscate some truth by adopting new terminology. It is not obvious what truth would be obfuscated by new terms.

In a democratic society, it is critically important to appreciate dissident views and to uphold the rights of dissidents. A citizen who disagrees with Latham and Sapienza, who deeply believes that an embryo formed by union of sperm and egg has high moral standing, but that neither an activated, unfertilized egg, nor an egg transplanted with somatic cell chromosomes, has such moral standing, needs more choices of words than one. That person will have to use multiple modifiers for the term embryo, instead of simpler, more accurate terms, such as “parthenote.” To that person, chromosome number is not nearly as important as chromosome origin.

There seems little justification in providing multiple, somewhat confusing modifiers to the term embryo simply to avoid agreeing upon new, clearer terminology. Both scientists and non-scientists would benefit from clearer, more precise discourse on the ethically challenging topic of the potential of human eggs to not only produce new members of the species, but perhaps repair existing members.

G. “What Is an Embryo?”: A Legal Perspective, *by Susan Crockin*⁷⁷

Attorney Crockin provides a useful comparison between the need for new descriptors for the new activities of eggs and the need for new terms to describe the new forms of “motherhood” created by assisted reproductive technologies. In contrast to the steadfast view of Professors Latham and Sapienza that the term “embryo” should be stretched to encompass all the new tasks of eggs, the term “mother” was not stretched to encompass all the possible combinations of gametes and uteri involved in modern assisted reproduction. More accurate terms such as “surrogate” and “gestational carrier” were adopted. New terms were needed because, as Crockin states: “Lawyers know that language matters and is often outcome determinative. Nowhere is this more readily apparent than in legal matters involving reproductive technologies and reproductive genetics—where contract, family, and constitutional law; genetics; and intentionality all come into play.”⁷⁸

Crockin discusses case law examples of legal definitions of

⁷⁶ Guenin, *supra* note 25, at 1131.

⁷⁷ Susan L. Crockin, “What Is an Embryo?”: A Legal Perspective, 36 CONN. L. REV. 1177 (2004).

⁷⁸ *Id.* at 1177.

“embryo,”⁷⁹ some of which were also included in the Commentary,⁸⁰ and clearly has personally adopted the term “preembryo,” as originally proposed by original members of the Jones infertility clinic in Norfolk, Virginia.⁸¹ As discussed in the Commentary, before assisted reproductive technologies, the early stages of development following fertilization were referred to as egg or zygote stages.⁸² But in order to distinguish fertilized from unfertilized eggs for infertility patients, the term “embryo” became common parlance for the zygote to the blastocyst stage. A variety of legal cases surrounding frozen embryos created the need to clarify that the developmental potential of early cleavage stages was, in fact, unknown because development had simply not been allowed to proceed long enough in culture.⁸³ The term “pre-embryo” was suggested to fill this need. The term has been useful to highlight the indeterminate state of a fertilized egg, but has received limited acceptance, partly because many reproductive biologists felt the existing term “zygote” would have been a better choice.

As Crockin discusses, the courts and legislators have struggled to decide and codify cases and laws that are fair to all parties, both the living and the potential. She proposes that similar exercises directed at resolving disputes over whether research involving eggs, in particular eggs transplanted with chromosomes from a somatic cell, should be embraced may be especially valuable in the current politically charged climate.

The overwhelming influence of government in this area of science is exemplified by: “In the summer of 2002, amidst the heated stem cell debates, Congress appropriated nearly one million dollars in federal funds to promote ‘embryo adoption’ . . .”⁸⁴

Also, in the fall of 2002, the Bush administration, through the Department of Health and Human Services (“HHS”), issued a new regulation making embryos and fetuses eligible for health care benefits under the State Children’s Health Insurance Program (“CHIP”) . . . The current administration also revised the charter of the federal advisory committee that oversees safety of human research volunteers to include “embryos” as “human subjects.”⁸⁵

It is clear from Attorney Crockin’s discussion and examples that a

⁷⁹ *Id.* at 1179–1181.

⁸⁰ Kiessling, *supra* note 2, at 1069 n.73.

⁸¹ Howard W. Jones, Jr. & Lucinda Veeck, *What is an Embryo?*, 77 FERTILITY & STERILITY 658, 659 (2002).

⁸² Kiessling, *supra* note 2, at 1053.

⁸³ ANN A. KIESSLING & SCOTT ANDERSON, HUMAN EMBRYONIC STEM CELLS: AN INTRODUCTION TO THE SCIENCE AND THERAPEUTIC POTENTIAL 70 (2003).

⁸⁴ Crockin, *supra* note 77, at 1183.

⁸⁵ *Id.* at 1184.

more open dialogue, with clearly defined and understood terms, is essential to avoid more confusing and disruptive legislation in the areas of assisted reproduction and stem cell biology.

III. SUMMARY OF THE RESPONSES

With the exception of Professor Robertson, who provided no comment about terminology, all Responders agreed that there exists ample confusion surrounding the activities of eggs, and that a fuller understanding of those activities by all parties would markedly improve the dialogue. Guenin as well as Latham and Sapienza disagreed that new terminology would help; their Responses espoused the view that the existing terms “embryo” and “clone” were adequate and what was needed was increased education of the public on the many meanings each of the terms could encompass. It is interesting that both of their Responses also held the view that embryos donated for research by couples undergoing fertility treatments should be used for stem cell derivation for therapeutic purposes, and that with additional education the public at large would come to accept this.

In contrast, Professors Shapiro and Quinn readily acknowledged the value of new terminology to help everyone understand the complex nuances of the biology of activated eggs. Both have had experience grappling with policy recommendations about the new technologies, especially Professor Shapiro who chaired President’s Clinton’s National Bioethics Advisory Commission.⁸⁶ Neither specifically advocated adoption of the terms suggested in the Commentary,⁸⁷ nor did they suggest alternates, but Quinn’s use of parthenote and ovasome within his Response clearly solved a terminology problem for him. This is very encouraging, particularly in light of Quinn’s mistaken view that my goal in the Commentary was to devalue human embryos.⁸⁸ The goal was to clarify the even greater therapeutic value of parthenotes and ovasomes.

Lars Noah had a more complex view of the value of new terminology, although he readily acknowledged the existing confusion in the field, as did Susan Crockin. Noah worried about additional terms simply adding to the “embryological Tower of Babel,”⁸⁹ whereas Crockin pointed out the new terms in use to describe alternate forms of “mother.”⁹⁰

All of the Responders espoused concern about the moral and ethical status of entities created through the use of human eggs, and the seemingly overwhelming problem of grappling with the concept of “when does life begin.” There was agreement that terminology should not be used to ne-

⁸⁶ See Shapiro, *supra* note 8.

⁸⁷ Kiessling, *supra* note 2, at 1088.

⁸⁸ See Quinn, *supra* note 56, at 1165.

⁸⁹ See Noah, *supra* note 33, at 1157.

⁹⁰ See Crockin, *supra* note 77, at 1177.

gate this concern.

Kevin Quinn was clear in his views that an embryo with potential to become a human holds a moral position much higher than egg products that could be a *tertium quid*,⁹¹ a wonderful phrase that has stretched my Latin, and for which I am still seeking a classic translation. He describes it as “an organism that can give rise to stem cells but is incapable of maturing beyond an early stage because it is genetically programmed to die early in its development.”⁹²

The latter statement would, obviously, solve the dilemma facing the use of embryos for research. Robertson expounds at length that using stem cells created from embryos is okay, but actually destroying the embryos to create the stem cells is highly problematic.⁹³ And Shapiro reminds us that if, in fact, destroying embryos for research is a form of murder, such acts come under the purview of existing laws.⁹⁴ Hence, reaching a consensus about the status of embryos frozen away in fertility clinics is becoming increasingly urgent.

The Commentary describes two “non-embryo” sources of stem cells for therapies: parthenotes, and ovasomes genetically engineered to be incapable of development to offspring.⁹⁵ Each of these could be the *tertium quid* that would not only solve the moral dilemma, but also provide more therapeutically valuable stem cells. It is interesting that the Responders did not comment on the concept of a genetically engineered ovasome, even though all acknowledged the deep moral problems with utilization of an embryo with developmental potential. It may be too early in the debate for such obvious solutions to be embraced.

The Responses to *What Is an Embryo?* have been enormously valuable in promoting an urgently needed debate on the science, ethics and legalities surrounding the activities of human eggs. I thank each of the Responders for offering important perspectives that have helped re-shape and focus my own energies in this area of science.

IV. THE CURRENT STATUS OF RESEARCH AND LEGISLATION

As this Rejoinder is being written, the U.S. is in the midst of a presidential election in which debates about stem cell research are playing a highly political role, even in the face of an ongoing, highly controversial, war in Iraq. No matter which side of the debate one is on, it is important to emphasize that the debate is occurring because as a nation, we are committed to the protection and well being of each and every citizen, even if

⁹¹ See Quinn, *supra* note 56, at 1168.

⁹² *Id.*

⁹³ See Robertson, *supra* note 14, at 1109–13.

⁹⁴ See Shapiro, *supra* note 8, at 1097.

⁹⁵ See Kiessling, *supra* note 2, at 1092.

they are but tiny clusters of cells arrested in liquid nitrogen, or wheelchair-bound patients rarely seen. The debate is public and rancorous, rich with demonstrations and outcry against elected officials, and at the heart of it is the deeply held conviction that we have a duty to protect and nurture every member of our community. The debate is about how best to do it, not whether it should be done. The overall health of such a society cannot be overstated. We are to be congratulated on reaching this level of socialization.

The Commentary included the advances in stem cell research summarized in the January 2004 report of the President's Council on Bioethics.⁹⁶ The single most significant advance was reported after the Council's summary by a Korean team of physicians and scientists who successfully derived the first line of stem cells from an ovasome.⁹⁷ It may be significant that the chromosomes transferred into the egg were from a cumulus cell, the same cell type reported to result in limited development in 2001.⁹⁸

The President's Council report emphasizes that, in fact, President Bush was the first U.S. President to allocate federal funds for any human embryonic stem cell research, and that the NIH budget for stem cells was increased to twenty million dollars in 2003.⁹⁹ It is important to note that this is 0.1% of the overall 20 billion dollar budget allocated to the NIH.

The federal restrictions on funding research on human embryos, parthenotes, or "clones" remains in effect in the form of the Dickey Amendment, originally introduced in 1996.¹⁰⁰ And the Bush administration has strengthened the protection of embryos as human subjects by adding "embryos" to the definition of "human subjects" in the charter of the federal advisory committee that oversees safety of human research subjects.¹⁰¹

It is unfortunate that the debate on embryonic human stem cells remains centered on the supply of frozen embryos in infertility centers. The facts that these are the ethically most controversial, and the therapeutically least valuable, have not reached either the public debate or the presidential candidate's remarks. It is not clear who is responsible for this oversight: scientists who have not been sufficiently outspoken, bioethicists who would rather debate the value of a human embryo than a human parthenote, or political advisors wishing to capitalize on a hot public topic.

At the center of the debate is public funding for the research. Overall, it is difficult to quantify "public" funding relative to "private sector" fund-

⁹⁶ MONITORING STEM CELL RESEARCH, *supra* note 6.

⁹⁷ Woo Suk Hwang et al., *Evidence of a Pluripotent Human Embryonic Stem Cell Line Derived from a Cloned Blastocyst*, 303 SCIENCE 1669, 1674 (2004).

⁹⁸ Jose B. Cibelli et al., *Somatic Cell Nuclear Transfer in Humans: Pronuclear and Early Embryonic Development*, 2 J. REGENERATIVE MED. 25, 25 (2001).

⁹⁹ MONITORING STEM CELL RESEARCH, *supra* note 6, at 1, 22.

¹⁰⁰ *Id.* at 25–28.

¹⁰¹ Crockin, *supra* note 77, at 1184.

ing for research nation-wide. The pharmaceutical companies quote their budgets in terms of billions of dollars a year, and large philanthropies, such as the Gates Foundation and the Howard Hughes Foundation, each allocate on the order of one billion dollars a year to biomedical research in one form or another. The NIH's twenty billion dollar a year budget is greater than those, but it must be spread over nearly twenty institutes and thousands of meritorious research projects. In the short term, even if public funding were agreed upon, it would be years before substantial funds would become available.

More important than the issue of public funding is the over-arching issue of legality. The House of Representatives has twice passed a bill that makes human nuclear transplantation into an egg a federal felony.¹⁰² A similar bill has been introduced into the Senate, but not as of this writing voted upon.¹⁰³ If the House bill as it is now written became law of the land, it would not only be illegal to conduct the research, it would be illegal for a patient to re-enter the country if he or she had received embryonic stem cell therapy in another country.¹⁰⁴ The severity of the language in the House bill reflects the genuine desire of many citizens to absolutely ensure that a human is not cloned; hopefully, before any legislation is passed by the Senate, the public dialogue will have reached a point of clear distinction between stem cell derivation and human cloning. Continuing the dialogue is urgent.

¹⁰² H.R. 2505, 107th Cong. (2001); H.R. 534, 108th Cong. (2003).

¹⁰³ H.R. 534, 108th Cong. (2003).

¹⁰⁴ H.R. 2505, 107th Cong. § 302(a)(3) (2001); H.R. 534, 108th Cong. § 302(a)(3) (2003).