

Biologists' Consensus on 'When Life Begins'

Steven Andrew Jacobs¹

Draft 1 of Working Paper – Posted to SSRN on July 25, 2018

Abstract

Many Americans disagree on when life begins because they have different interpretations of the phrase: descriptive (i.e., when a fetus is classified as a human) and normative (i.e., when a fetus is worthy of ethical and legal consideration). To determine which is more prevalent, 2,899 American adults were surveyed and asked to select the group most qualified to determine when a human's life begins. 81% selected biologists as the most qualified because they are scientists who objectively study life. This suggests Americans likely have a descriptive interpretation of 'when life begins'. Biologists were then recruited to participate in a study. A sample of 5,502 biologists from 1,058 academic institutions assessed statements representing the biological view 'a human's life begins at fertilization'. A consensus affirmed each of the three statements representing that view (75-91%). Overall, 95% of biologists affirmed the view (5212 out of 5502). These findings suggest the descriptive view on when life begins centers on the biological classification of a fetus as a human at fertilization. These findings do not necessitate legal consideration of fetuses because it is not known if fetuses deserve rights or how those rights would be balanced against women's reproductive rights. However, these findings can lead to such discussions. Biologists' consensus on the descriptive view can help Americans move past the factual dispute on when life begins and focus on the normative issues in the abortion debate.

Keywords

human development, when life begins, abortion, scientific consensus, survey of Americans, survey of biologists, MTurk

♦ Jacobs, S. A. "Biologists' Consensus on 'When Life Begins'". *SSRN*, 2018. Available at: http://papers.ssrn.com/paper.taf?abstract_id=3211703.

¹ Current Ph.D. candidate in the Department of Comparative Human Development at the University of Chicago, 2016 graduate of Northwestern Law's Accelerated J.D. Program, and mediator certified by The Center for Conflict Resolution. All correspondence should be sent to Steve Jacobs (stevejacobs@uchicago.edu).

Introduction

While people agree that women have the right to make reproductive decisions involving their own bodies, many debate if those decisions directly affect other humans' bodies. This dispute on when a human's life begins likely plays a role in Americans' ethical and legal positions on abortion. Since there is higher support of legal abortion access in the first trimester (60%) than the second (28%) and third (13%) trimesters of pregnancy², the dispute is not a matter of *if* abortion directly impacts another human's body – it is a matter of *when*.³ However, many debate the question's importance⁴, if the question is answerable⁵, and the meaning of people's answers to the question.⁶

'When does a human's life begin?' is subject to David Hume's classic *is-ought* problem⁷ since the question has two primary interpretations: the descriptive view (i.e., when *is* a fetus classified as a human) and the normative view (i.e., when *ought* a fetus be recognized as a person worthy of ethical and legal consideration⁸). The *is-ought* fallacy is present in some pro-life stances that confuse the former for the latter such that a certain descriptive view necessitates a corresponding normative view (e.g., 'since a human's life begins at fertilization, fetuses are worthy of legal protection throughout pregnancy'). This fallacy is also present in some pro-choice stances that confuse the latter for the former such that a certain normative view necessitates a corresponding descriptive view (e.g., 'since fetuses are not worthy of legal protection, a human's life begins at birth'). Careful consideration of the specific language used in a stance on when life begins is required to understand which interpretation drove that stance.

The linguistic structure utilized in a person's response to the question serves as evidence for the person's interpretation of the question. The language in some responses give little indication of

² Saad, L. "Trimesters Still Key to U.S. Abortion Views". *Gallup*, 2018. <https://news.gallup.com/poll/235469/trimesters-key-abortion-views.aspx>.

³ Moore, P. "Three quarters say Longmont attack is murder". 2015. Available at: <http://today.yougov.com/topics/politics/articles-reports/2015/04/07/three-quarters-say-longmont-attack-murder>; Elliott T. A., Friedman, J. A., Siegel, E. T., Kort, H. I., & Nagy, Z. P. "When does life begin? Results of an online survey". *Fertility and Sterility*, 2008. Available at: [http://www.fertstert.org/article/S0015-0282\(08\)01732-9/fulltext](http://www.fertstert.org/article/S0015-0282(08)01732-9/fulltext).

⁴ Johnson, A. "Planned Parenthood President: When Life Begins Not 'Really Relevant' in Abortion Debate". *National Review*, 2014. Available at: <https://www.nationalreview.com/corner/planned-parenthood-president-when-life-begins-not-really-relevant-abortion-debate/> (citing: <https://www.youtube.com/watch?v=ZdK--xwxwBA>).

⁵ Zhang, S. "Why Science Can't Say When a Baby's Life Begins". *Wired Magazine*, 2015. Available at: <https://www.wired.com/2015/10/science-cant-say-babys-life-begins/>.

⁶ Henriques, G. "When Does 'It' Become a Person?". *Psychology Today*, 2015. Available at: <https://www.psychologytoday.com/us/blog/theory-knowledge/201508/when-does-it-become-person>.

⁷ Hume, D. "A Treatise of Human Nature". 1759. Available at: <http://www.davidhume.org/texts/thn.html>; Garrett, D. "Hume". *Routledge*, p. 146-171, 2015; Pigden, C. "Hume On Is and Ought: Logic, Promises and the Duke of Wellington". In Paul Russell (ed.), *The Oxford Handbook on David Hume*. Oxford University Press, 2016.

⁸ Legal consideration was used because it is broader than legal protection. The former implies that a fetus might have rights that can be balanced against a woman's rights; the latter implies that a woman's rights are secondary to a fetus' rights.

the person's interpretation (e.g., 'life begins at conception', 'life begins at birth'). Others more clearly signal a descriptive interpretation (e.g., 'a human's biological development begins at fertilization') or a normative interpretation (e.g., 'the woman gets to decide when the fetus is a person'). The phrasing of a nonresponsive answer can similarly indicate how the question was understood. If one argues 'it is not known when a human's life begins', they likely have a descriptive interpretation since they represented it as a knowable question on when a human is first classified as such. If one argues 'when a fetus is a person is a matter of opinion', they likely have a normative interpretation since they represented it as a value judgment on when a fetus is a person worthy of ethical and legal consideration.

This *is-ought* analysis can explain why people disagree on when life begins. Disagreement might not emanate from different biological views on when to classify a fetus as a human or different judgments on when a fetus is deserving of legal consideration. Conflicting stances could merely represent that one person interprets 'when life begins' descriptively while the other interprets it normatively. Thus, Americans could merely disagree because they understand the question differently.

Contemporary Discussions on 'When Life Begins'

Cecile Richards, the former president of Planned Parenthood⁹, has stated that experts believe there is no specific moment when a life begins because it is a variable point that depends on each pregnancy.¹⁰ Politicians have also suggested that the ontogenetic starting point of a human's life is unknown. In defense of her support of *Roe v. Wade*, the landmark U.S. Supreme Court case that founded federal abortion protections, Congresswoman Nancy Pelosi argued, "I don't think anyone can tell you when life begins."¹¹ Both answers indicate a descriptive interpretation of the question. Cecile Richards' statement suggests she believes 'when life begins' can be medically determined in each pregnancy, and Nancy Pelosi's statement suggests she believes 'when life begins' is a knowable factual matter, not a matter of opinion (e.g., 'no one person should get to determine when life begins').

Other politicians believe it is a settled issue. In defense of his abortion stance, 2016 Republican Party presidential candidate Senator Marco Rubio once said, "I believe that science is clear... when

⁹ Planned Parenthood is a nonprofit that provides reproductive services around the world, and it is recognized as the leading abortion provider in the U.S. See: Umhouefer, D. "Glenn Grothman says Planned Parenthood is leading abortion provider". *Politifact Wisconsin*, 2017. Available at: <http://www.politifact.com/wisconsin/statements/2017/may/15/glenn-grothman/glenn-grothman-says-planned-parenthood-leading-abo/>.

¹⁰ Hochman, D. "The Playboy Interview With Cecile Richards". *Playboy*, 2018. Available at: <https://www.playboy.com/read/playboy-interview-cecile-richards>.

¹¹ Pelosi, N. "Meet the Press interview with Tom Brokaw". 2008. Available at: <https://www.youtube.com/watch?v=G8FmLCm2CiI>.

there is conception that that [sic] is a human life in the early stages of its total development that is worthy of the protection of our laws.”¹² Here, Senator Rubio responded to both perspectives of when life begins, seemingly arguing that a certain descriptive view (i.e., there is a human life at conception) necessitates a certain normative view (i.e., a fetus is worthy of legal protection throughout pregnancy).

These views are echoed by the current U.S. President, since he similarly argues that a fetus is a human worthy of legal protection. President Donald Trump advanced this stance in a letter to the National Right to Life Committee: “[a]s President I am dedicated to protecting the lives of every American including the unborn”.¹³ This belief was memorialized on January 22, 2018, the National Sanctity of Human Life day, when President Trump announced that “[t]oday, we focus our attention on the love and protection each person, born and unborn, deserves regardless of disability, gender, appearance, or ethnicity... [and] no class of people should ever be discarded as ‘non-human.’”¹⁴ Under his direction, the U.S. Department of Health and Human Services (HHS) updated its strategic plan to recognize this view.¹⁵ However, an HHS representative denied they were taking a political stance: “[n]o, the department is finally looking to and acknowledging science”.¹⁶ These political stances are not mere talking points; they can affect U.S. policy and potentially impact America’s abortion laws.

History of U.S. Abortion Laws

‘When life begins’ has played a central role in the United States’ centuries-long legislative debate on abortion. Until the 19th century, quickening was recognized as the moment life began because fetal movements in the uterus served as proof that a woman was pregnant. This descriptive view served as the basis of the normative view under U.S. common law because “[o]nce quickening occurred, women recognized a moral obligation to carry the fetus to term”.¹⁷ Quickening later gave way to the view espoused by Dr. Horatio Storer and the American Medical Association (AMA). In

¹² Scott, E. “Marco Rubio defends abortion stance: Human life begins at conception”. *CNN*, 2015. Available at: <https://www.cnn.com/2015/08/07/politics/marco-rubio-abortion-republican-debate-gop/>.

¹³ Ertelt, S. “President Donald Trump: Unborn Babies Have a “Basic and Fundamental Human Right, the Right to Life”. *LifeNews.com*, 2018. Available at: <http://www.lifenews.com/2018/06/28/president-donald-trump-unborn-babies-have-a-basic-and-fundamental-human-right-the-right-to-life/>.

¹⁴ “President Donald J. Trump Proclaims January 22, 2018, as National Sanctity of Human Life Day”. *The White House*, 2018. Available at: <https://www.whitehouse.gov/presidential-actions/president-donald-j-trump-proclaims-january-22-2018-national-sanctity-human-life-day/>.

¹⁵ “Strategic Plan FY 2018 - 2022.” *U.S. Department of Health & Human Services*. Available at: <https://www.hhs.gov/about/strategic-plan/index.html>.

¹⁶ Burger, J. “HHS draft plan recognizes that life begins at conception”. *Aleteia*, 2017. Available at: <https://aleteia.org/2017/10/14/health-and-human-services-draft-plan-recognizes-that-life-begins-at-conception/>.

¹⁷ Reagan, L.J. “When Abortion Was a Crime: Women, Medicine, and Law in the United States, 1867-1973”. *University of California Press*, 1997, p. 8-9.

the 1857 report of the Committee on Criminal Abortion, the AMA took the stance that “the child is really alive from the very moment of its conception, and from that very moment is, and should be considered, a distinct being”.¹⁸ That stance drove the nationwide passage of state laws that restricted abortion throughout all stages of pregnancy. This reflected Americans’ continued use of a descriptive view to establish the normative view in their abortion laws. After a century of abortion bans, both views were redefined in 1973 by the U.S. Supreme Court in *Roe v. Wade*.

Justice Harry Blackmun wrote the Court’s opinion and considered multiple theories on when life begins. He suggested that “those trained in the respective disciplines of medicine, philosophy, and theology” were the experts whose consensus on when life begins would be relevant to the Court’s opinion since “the judiciary, at this point in the development of man’s knowledge, is not in a position to speculate as to the answer”.¹⁹ However, the Court could not find a consensus view among experts and replaced the AMA’s stance with the descriptive view that “the fetus, at most, represents only the potentiality of life”. The Court ultimately argued that the “potentiality of human life... grows” during pregnancy and first reaches a compelling point at fetal viability (i.e., the point at which medical technology could facilitate a fetus’ survival after a premature birth). This descriptive view was consistent with the Court’s normative view, “[w]ith respect to the State’s important and legitimate interest in potential life, the ‘compelling’ point is at viability”, since the Court held that life can be protectable at viability.²⁰ Since *Roe* used viability as both the moment when a fetus’ life begins and as the legal dividing line in pregnancy²¹, the Court continued the U.S. legal trend of deeming a fetus worthy of legal consideration at the point when a fetus has been classified as a human.

The descriptive and normative views of *Roe* are currently used as the basis for U.S. abortion laws²², but anti-abortion politicians continue to challenge these views. Federal lawmakers have made numerous attempts to pass human life amendments to the U.S. Constitution and redefine the beginning of life as conception to protect fetuses throughout pregnancy.²³ Federal lawmakers have

¹⁸ “Suffolk District Medical Society Report [of the Committee on Criminal Abortion]”. Boston, 1857, p. 8. Available at: <https://collections.nlm.nih.gov/bookviewer?PID.nlm:nlmuid-101218760-bk>, pp. 10.

¹⁹ *Roe v. Wade*. 410 U.S. 113, 159 (1973).

²⁰ *Id.* at 163-165.

²¹ *Id.* at 159. Justice Blackmun signaled that he understood the distinction between the descriptive and normative interpretations of when life begins: “Texas urges that... life begins at conception and is present throughout pregnancy, and that, therefore, the State has a compelling interest in protecting that life from and after conception. We need not resolve the difficult question of when life begins”; additionally, he precluded the view that a fetus is classified as a human at fertilization by referring to previable fetuses as “potential human life”.

²² The essential holding of *Roe*, in part that a fetus is a potential human life, was upheld in *Planned Parenthood v. Casey*, 505 U.S. 833, 834 (1992) and *Whole Woman’s Health v. Hellerstedt*, 579 U.S. ____ (2016).

²³ Lohr, K. “Human Life’ Amendments Latest Challenge to Roe”. *NPR*, 2008. Available at: <http://www.npr.org/templates/story/story.php?storyId=18292863>.

also worked to restrict abortion access with a bill that would protect fetuses that are sentient (i.e. capable of experiencing pain).²⁴ Similar attempts have taken place on the state level. Recently, Iowa state legislators passed a ‘heartbeat bill’ to protect a fetus once its heartbeat has been detected, taking the position that a heartbeat signals the beginning of a life.²⁵ Some predict it will trigger the next challenge to *Roe*²⁶, and politicians have suggested this was the very purpose of the bill and the law.²⁷

Summary

The logic of U.S. abortion laws has remained constant for centuries. The legal dividing line in pregnancy has merely moved according to the arbiters’ determination on the *is* dimension of ‘when life begins’ (i.e., first society, then the AMA, and finally the U.S. Supreme Court). Thus, courts and lawmakers have a long and consistent history of using a fetus’ developmental landmarks to form their view on when a fetus is classified as a human, which they then use as the bright line that separates legal abortions from illegal abortions. Americans have either believed that the descriptive and normative interpretations are fungible or that a certain descriptive view necessitates a corresponding normative view (i.e., a human’s life is worthy of legal consideration when it begins).²⁸ However, it is not known whether this is still true for Americans. It is possible that traditional ethical and legal concepts have been impacted by contemporary modes of thinking that find the descriptive view irrelevant to normative issues in the U.S. abortion debate (e.g., the view that a woman needs reproductive rights for the protection of her rights to autonomy, liberty, and equality).²⁹

²⁴ O’Keefe, E. “Abortion ban bill fails to advance in the Senate”. *Washington Post*, 2018. Available at: http://www.washingtonpost.com/politics/abortion-ban-bill-fails-to-advance-in-the-senate/2018/01/29/98ad2c0e-0518-11e8-94e8-e8b8600ade23_story.html.

²⁵ After signing the bill into law, Iowa Governor Reynolds argued, “if death is determined when a heart stops beating, then doesn’t a beating heart indicate life?”. Pfannenstiel, B. & Petroski, W. “The nation’s strictest abortion ban is now law. Iowa Gov. Kim Reynolds signs ‘fetal heartbeat’ bill”. *Des Moines Register*, 2018. Available at: <https://www.desmoinesregister.com/story/news/politics/2018/05/04/abortion-ban-law-iowa-fetal-heartbeat/577443002/>.

²⁶ Ingber, S. “Iowa Bans Most Abortions As Governor Signs ‘Heartbeat’ Bill”. *NPR*, 2018. Available at: <http://www.npr.org/sections/thetwo-way/2018/05/05/608738116/iowa-bans-most-abortions-as-governor-signs-heartbeat-bill>.

²⁷ For example, Iowa State Senator Rick Bertrand signaled this view: “I believe this bill will be the vehicle that will ultimately provide change and provide the opportunity to overturn *Roe v. Wade*”, Shaw, M. “Iowa’s new six-week ‘heartbeat’ abortion bill is a blatant attempt to reverse *Roe v. Wade*”. *NBC News*, 2018. Available at: <https://www.nbcnews.com/think/opinion/iowa-s-new-six-week-heartbeat-abortion-bill-blattant-attempt-ncna871561>.

²⁸ It is unknown which principle would justify the argument that a certain descriptive view would necessitate a corresponding normative view, but this principle is consistent with rights concepts outlined in the Universal Declaration of Human Rights, which extend rights to all humans: “[e]veryone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status”. “Universal Declaration of Human Rights”. *United Nations*. Available at: <http://www.un.org/en/universal-declaration-human-rights/>.

²⁹ “Reproductive Rights are Human Rights”. *Center for Reproductive Rights*, 2009. https://www.reproductiverights.org/sites/crr.civicactions.net/files/documents/RRareHR_final.pdf.

This article proceeds to explore these questions with two studies. Study 1 sought to determine whether one of the interpretations is more prevalent. In an online survey, American participants were asked to select the group most qualified to determine when a human's life begins. Resulting data indicated that most Americans hold one of the views. Study 2 sought to inform discussions on that view. In an online survey, Americans' chosen group of experts were asked to determine when life begins. Together, these studies operationalized the question and provided data on the experts' answer. While this might appear to be an *argumentum ad populum* (i.e., arguing something is true because it's popular), using participants' chosen experts to resolve the question does not suggest that the group would actually be most qualified. That group would just be able to make the determination that Americans are most likely to accept. Mediators and dispute resolution experts often ask parties to agree on a third-party source or authority that can resolve fundamental disputes between the parties.

Study 1 – Americans' Opinions on 'When Life Begins'

A large random sample of Americans was first asked whether they believe "[w]hen does a human's life begin?" is an important question in the U.S. abortion debate. Next, participants were asked to select the group most qualified to answer the question. The list was created to allow for inferences on whether Americans' primarily hold a descriptive or a normative interpretation of the question. Participants were given biologists as the descriptive option, since biologists are life scientists trained to classify living things. Participants were given religious leaders, voters, philosophers, and Supreme Court Justices as the normative options, since these groups have different perspectives on the same essential question of when a fetus is a human worthy of ethical and legal consideration.

Methods

Participation was sought from American adults through Amazon's Mechanical Turk workforce site (MTurk), which is the service many academic researchers³⁰ use to connect with large participant pools. 2,979 American participants answered the advertisement on a survey about "a

³⁰ Buhrmester, M., Kwang, T., & Gosling, S. D. "Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data?". *Perspectives on Psychological Science*, 2011, 6, p. 3-5; Bates, J. A., & Lanza, B. A. "Conducting psychology student research via the Mechanical Turk crowdsourcing service". *North American Journal of Psychology*, 2013, 15(2), p. 385-394; Buhrmester, M. & Talafar, S. & Gosling, S. "An Evaluation of Amazon's Mechanical Turk, Its Rapid Rise, and Its Effective Use". *Perspectives on Psychological Science*, 2018, 13, p. 149-154. Available at: <https://doi.org/10.1177/1745691617706516>.

popular American debate”. 2,899 participants provided data on the operative question.³¹ Politically, the sample was predominantly pro-choice (63%), liberal (63%), and Democratic (67%). The sample was well-educated (62% graduated from college) and had more females (58%) than males (42%). The demographics were consistent with previous findings on the demographics of MTurk samples.³²

The surveys focused on the role ‘when life begins’ plays in the U.S. abortion debate, but they also included subsequent broader rights questions that are not analyzed in this article. Participants were presented a list of experts (i.e., biologists, religious leaders, voters, philosophers, and Supreme Court Justices) and asked to select the group most qualified to determine when a human’s life begins. This list was generated from the U.S. Supreme Court opinion on *Roe v. Wade*.³³ As a follow-up question, many participants were presented an open-ended essay prompt so they could explain the reasoning behind their selection. The main questions investigated in this article are as follows:

- **Q1:** “How important is the question ‘When does a human's life begin?’ in the US Abortion Debate?” (1=Unimportant, 10=Important)
- **Q2:** “Americans deserve to know when a human's life begins so they can be informed in their abortion positions and reproductive decisions.” (1=Do Not Agree, 10=Agree)
- **Q3:** “Which group is most qualified to answer the question ‘When does a human's life begin?’”
- **Q4:** “Why do you think they are most qualified?”

Results

In response to Q1, 87% of participants (2294 out of 2633) rated ‘when a human’s life begins’ as an important issue. In response to Q2, 84% (1983 out of 2355) agreed with the statement representing the view that Americans deserve to know when a human's life begins so they can be informed in their abortion positions and reproductive decisions. These results suggest that ‘when life begins’ is still perceived as a relevant issue in the U.S. abortion debate.

In response to Q3, 81% of participants (2336 out of 2899; 99% CI [79.1%, 82.9%]) selected biologists over religious leaders (7%), voters (7%), philosophers (4%), and Supreme Court Justices (2%) (Figure 1). This suggests the question is interpreted descriptively as ‘when is a fetus classified as a human’. Since most participants selected biologists, they likely understand ‘a human’s life’ as a biological concept that represents a member of the human species. Since few selected the groups whose selection would suggest a normative view, they do not likely understand ‘a human’s life’ as a

³¹ 587 participants were offered \$.26 for participating, and 2,312 participants were offered \$.51 for participating.

³² Huff, C. & Tingley, D. “Who are these people? Evaluating the demographic characteristics and political preferences of MTurk survey respondents”. *Research & Politics*, 2015, 2(3), p. 1-12. Available at: <https://scholar.harvard.edu/files/dtingley/files/whoarethesepeople.pdf>

³³ *Roe v. Wade*. 410 U.S. 113, 159 (1973).

metaphysical, value-laden concept that represents a person deserving of ethical and legal consideration.

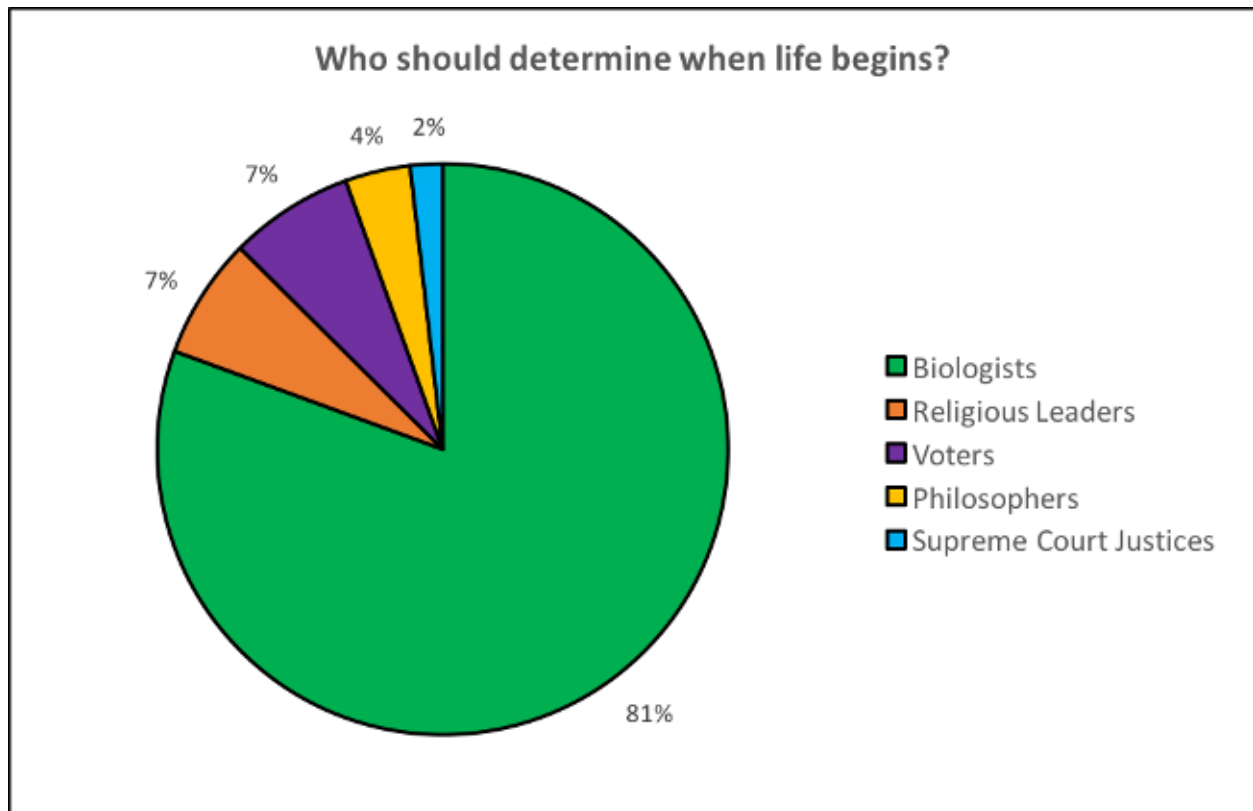


Figure 1. Participants' selections in response to the question: "Which group is most qualified to answer the question 'When does a human's life begin?'".

In response to Q4, 91% of participants that selected biologists (1663 out of 1820) argued that when life begins is an objective matter and biologists' scientific knowledge makes them best suited to resolve the issue. Their responses suggest biologists were selected because Americans recognize "[w]hen does a human's life begin?" as a fundamentally objective question that calls for an answer from a biological perspective. Finally, in a sample of the Americans who selected biologists, participants predicted biologists would agree on when life begins (67%; 622 out of 930) and predicted a consensus determination by biologists would strengthen the pro-choice side of the U.S. abortion debate (56%; 525 out of 932).

Summary

When asked to select the group most qualified to determine when a human's life begins, most Americans chose biologists because participants recognized them as objective scientists well-suited to

determine the descriptive view of when a fetus is classified as a human. Few chose groups well-suited to provide a normative view of when a human is worthy of legal consideration (i.e., religious leaders, voters, philosophers, and Supreme Court Justices). Thus, American participants' consensus selection of biologists and their justifications of that selection suggest the descriptive interpretation is most salient in discussions on how to determine when life begins. Altogether, these findings suggest that the descriptive view of when life begins is relevant and properly operationalized as 'when is a fetus biologically classified as a human'.

Accordingly, the questions in Study 2 were constrained to the biological view of when life begins. The measures were free from any mention of rights or laws, so participants could focus solely on the *is* question. This framing signaled to biologists that they should answer questions descriptively based on their scientific view and that their normative view is not relevant. Thus, academic biologists were surveyed to learn if there is a consensus biological view on when life begins.

Study 2 – Biologists' Determination on 'When Life Begins'

While science is not typically done by consensus, such exercises have contributed to the global warming debate.³⁴ This method is especially helpful in debates with political implications because such topics can motivate scientists to take stances based on their personal or political opinions, rather than stances that result from their training as scientists. Accordingly, personal or political bias is likely less impactful in a survey of thousands of scientists than in a collection of anecdotal evidence from a small group of experts.³⁵ A large sample can also allow for comparisons of groups with different ideological or political stances and allow for analyses that measure these differences. To represent these differences, a table was created to present data from 60 groups of biologists that were separated along 11 different dimensions. For a robust view of biologists, a consensus of these groups would have to affirm the view. This nuanced analysis would suggest whether the finding is ubiquitous among all groups of biologists or if the finding was being driven by a certain religious belief (e.g., Atheism, Catholicism), a stance on abortion (e.g., pro-choice, pro-life), or a life circumstance (e.g., not having children, having four children).

³⁴ Vaidyanathan, G. "How to Determine the Scientific Consensus on Global Warming". *ClimateWire*, 2014. Available at: <http://www.scientificamerican.com/article/how-to-determine-the-scientific-consensus-on-global-warming>.

³⁵ In 1981, the U.S. Senate Judiciary Committee heard testimonial evidence from physicians and biologists that further reinforced disagreement on when life begins. "Report". *Subcommittee on Separation of Powers to Senate Judiciary Committee S-158*, 97th Congress, 1st Session 1981.

Methods

Participation was sought from biologists associated with colleges, universities, and institutes around the world. A list of academic institutions was generated from rankings of biology programs.³⁶ Contact information of post-docs, lecturers, professors, and professors emeriti was collected from the institutions' biology and life science faculty pages. Altogether, 62,469 academic biologists were recruited through e-mail and 7,383 participated in the study (12% survey response rate³⁷).³⁸ Of those participants, 5,502 biologists from 1,058 academic institutions provided analyzable data by assessing at least one of the three biological statements (Q1-Q3).³⁹ The majority of the sample was male (63%) and 95% held a PhD. The sample was predominantly non-religious (63%). As in Study 1, there were more liberals (89%) than conservatives (11%), Democrats (92%) than Republicans (8%), and pro-choice supporters (85%) than pro-life supporters (15%).⁴⁰ The sample included biologists that were born in 86 countries around the world.

The surveys focused on the biological view of when a human's life begins, but the surveys also included questions about a range of related scientific concepts (e.g., genetics and epigenetics) that are not analyzed in this article. Most questions called for participants' assessment of whether a statement was "Correct" or "Incorrect". The statements described the specific biological view that 'a human's life begins at fertilization'. This was used because previous polls and surveys have suggested this is a popular view among scientific experts and laypeople.⁴¹ Participants were also given an open-ended

³⁶ "Best Graduate Biological Sciences Programs". *U.S. News*, 2018. Available at: <https://www.usnews.com/best-graduate-schools/top-science-schools/biological-sciences-rankings>; "QS World University Rankings by Subject 2015 - Biological Sciences". 2015. Available at: <https://www.topuniversities.com/university-rankings/university-subject-rankings/2015/biological-sciences>.

³⁷ This response rate is similar to what was found in a recent study of sociologists, see: Horowitz, M., Haynor, A., & Kickham, K. "Sociology's Sacred Victims and the Politics of Knowledge: Moral Foundations Theory and Disciplinary Controversies". *The American Sociologist*, 2018 1-37. Available at: <https://doi.org/10.1007/s12108-018-9381-5>.

³⁸ In Study 2, 7,383 participants started a survey and 6,646 gave at least one substantive answer to a question (89%); substantive answers included responsive answers to preliminary questions on genetics that were posed to activate participants' biological reasoning (along with missing data and other nonresponsive answers, these were not included in the analyses in this paper); this response rate (89%) reflected the RR2, which includes completed and partial interviews, see: "Standard Definitions". *American Association for Public Opinion Research*, 2015. Available at: http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions2015_8theditionwithchanges_April2015_logo.pdf.

³⁹ Every participant that affirmed or rejected at least one biological statement (Q1-Q3) was included (N = 5502); the item response rates of all four questions (Q1-Q4) were above the 70% threshold, so they did not trigger a nonresponse bias analysis, see: National Research Council. "Nonresponse in Social Science Surveys: A Research Agenda". Washington, DC: *The National Academies Press*, 2013, p. 46. Available at: <https://doi.org/10.17226/18293>.

⁴⁰ Participants rated themselves on three scales from 1-10 that had "pro-choice", "liberal", and "democratic" (1 through 5) on one end and "pro-life", "conservative", and "democratic" on the other end (6 through 10).

⁴¹ Elliott T. A., Friedman, J. A., Siegel, E. T., Kort, H. I., & Nagy, Z. P. "When does life begin? Results of an online survey". 2008. Available at: [http://www.fertstert.org/article/S0015-0282\(08\)01732-9/fulltext](http://www.fertstert.org/article/S0015-0282(08)01732-9/fulltext); Moore, P. *Three quarters say Longmont attack is murder*. YouGov, 2015. Available at: <http://today.yougov.com/topics/politics/articles-reports/2015/04/07/three-quarters-say-longmont-attack-murder>.

survey question on their biological view of ‘when a human’s life begins’. The main questions investigated in this paper are as follows:

- **Q1 - Implicit Statement A**
 - “The end product of mammalian fertilization is a fertilized egg (‘zygote’), a new mammalian organism in the first stage of its species’ life cycle with its species’ genome.”
- **Q2 - Implicit Statement B**
 - “The development of a mammal begins with fertilization, a process by which the spermatozoon from the male and the oocyte from the female unite to give rise to a new organism, the zygote.”
- **Q3 - Explicit Statement**
 - “In developmental biology, fertilization marks the beginning of a human's life since that process produces an organism with a human genome that has begun to develop in the first stage of the human life cycle.”
- **Q4 - Open-Ended Essay Question**
 - “From a biological perspective, how would you answer the question ‘When does a human's life begin?’”

Q1-Q3 vary in how explicitly they frame a descriptive view on when life begins, so all three were used to develop a robust understanding of participants’ assessment of the biological view that ‘a human’s life begins at fertilization’. However, all three could be argued to be logically and biologically equivalent.⁴² The implicit statements represent the ‘textbook view’ that fertilization produces an organism at the beginning of the ontogenetic developmental process of mammals (i.e., the mammalian life cycle)⁴³. The explicit statement focuses on a specific species of mammals, ‘humans’ (i.e., *Homo sapiens sapiens*)⁴⁴, and concretely frames the implied ontogenetic life cycle as ‘a life’ – these elements are collectively represented by the phrase “a human’s life”. While Q1-Q3 were assessments of a specific view on when life begins, the open-ended essay question (Q4) was incorporated to learn the view biologists would focus on when they were free to write about the biological view they believe to be most correct.

⁴² Indeed, many participants complained in the comments section about how these questions seemed repetitive and many responded to Q4 by saying, ‘I’ve already answered this question multiple times’.

⁴³ Seisenberger, S. et al. “Reprogramming DNA methylation in the mammalian life cycle: building and breaking epigenetic barriers”. *Phil. Trans. R. Soc.*, 2012.

⁴⁴ Foley, N. M., Springer, M. S., & Teeling, E. C. “Mammal madness: is the mammal tree of life not yet resolved?”. *Phil. Trans. R. Soc. B.*, 2016. Available at: <https://doi.org/10.1098/rstb.2015.0140>.

Results

In response to Q1, 91% of participants (4542 out of 4979) affirmed the first statement. In response to Q2, 88% of participants (3974 out of 4498) affirmed the second statement (Figure 2). These were implicit statements of the biological view as they replaced concepts that could be perceived as normative (e.g., “human”, “life”) with descriptive terms (e.g., “mammalian”, “development”). These statements retained the core argument for biologically classifying humans (i.e., a zygote with a human genome is a new human organism developing in the first stage of the human life cycle), so it can be argued that affirming one of the implicit statements is logically equivalent to affirming the biological view that ‘a human’s life begins at fertilization’.

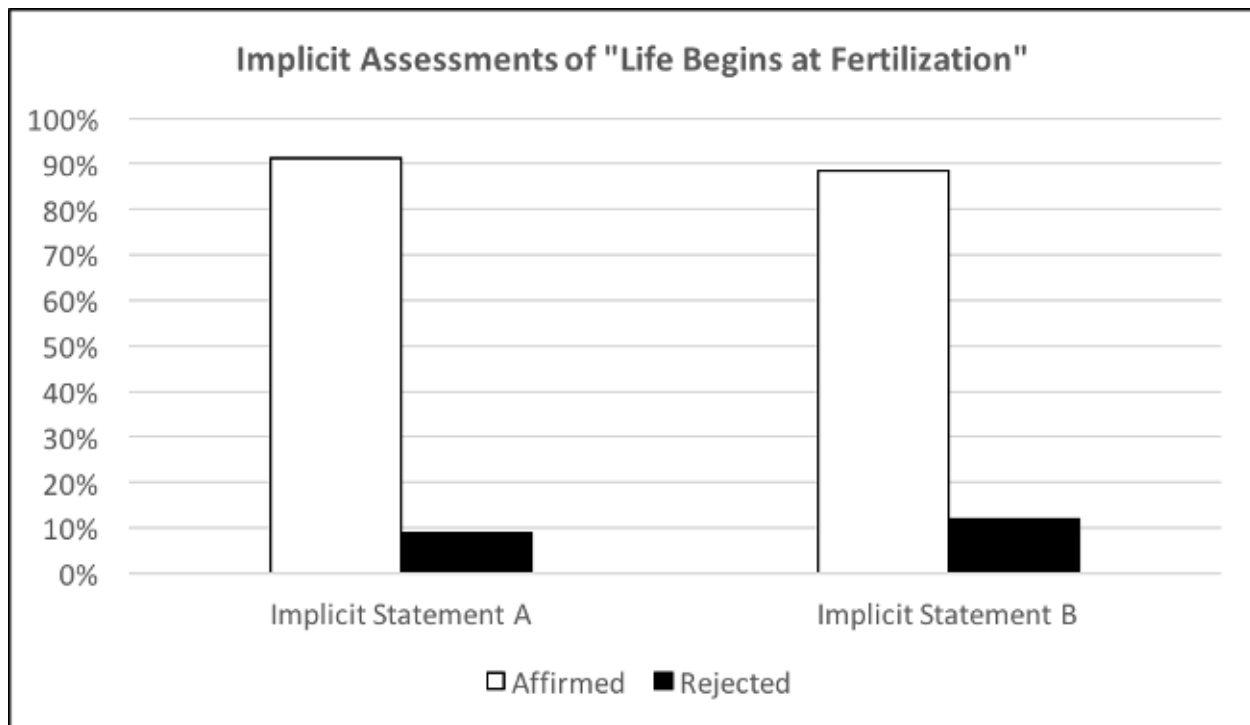


Figure 2. Participants’ assessments of Implicit Statement A (“The end product of mammalian fertilization is a fertilized egg...”) and Implicit Statement B (“The development of a mammal begins with fertilization...”).

In response to Q3, 75% of participants (2493 out of 3336) affirmed the explicit statement that contained language that could trigger extrabiological modes of thinking and normative interpretations of ‘when life begins’ (e.g., “human”, “life begins”). This language could have been a contributing factor in the lower level of support of the explicit statement, since the implicit statements did not contain such language.

To better understand this lower level of support, which could be driven by participants' normative interpretations, participants were separated into groups based on their abortion stances (Figure 3). While there was consensus in each group, the affirmation rate of very pro-choice biologists (69%; 1331 out of 1932) was lower than neutral biologists (86%; 178 out of 208) and very pro-life biologists (92%; 238 out of 259). The lower affirmation rate of pro-choice biologists, compared to the other groups, could be due to the higher rate at which the explicit statement activated pro-choice biologists' normative interpretations. Such interpretations could lead to a higher rejection rate of the explicit statement since the common pro-choice normative view precludes the legal recognition of a fetus at fertilization.

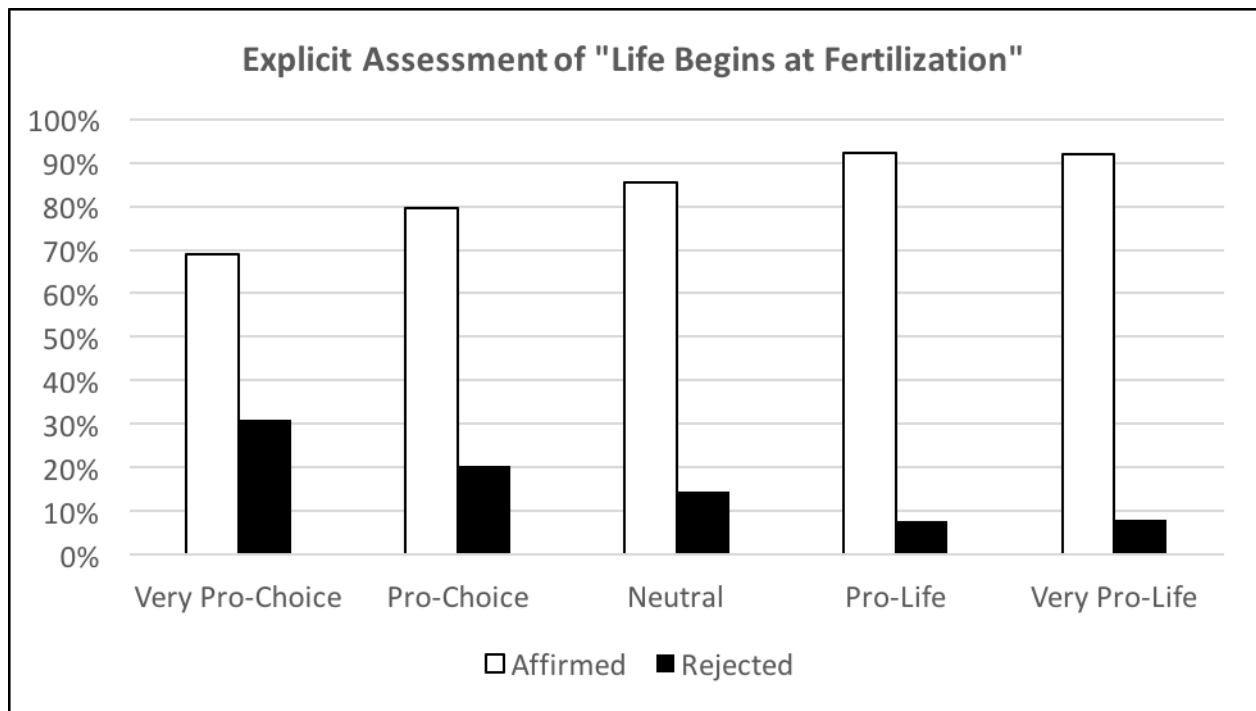


Figure 3. Participants' assessments of the statement: "In developmental biology, fertilization marks the beginning of a human's life...". Separated by participants' abortion stances.

In Table 1, participants' affirmation rates for Q1-Q3 were further broken down into 60 categories (e.g., pro-life, pro-choice, conservative, liberal, Republican, Democrat) along 11 dimensions (e.g., abortion stance, ideological stance, political stance). Consensus was found in each group for each question. Affirmation rates ranged from 86-99% for Q1, 81-99% for Q2, and 65-96% for Q3.

Table 1 Biologists' Affirmation Rates

Group	Q1 – Implicit A	Q2 – Implicit B	Q3 – Explicit
All Participants	91% (N = 4979)	88% (N = 4498)	75% (N = 3336)
<u>Education</u>			
Master's	93% (N = 138)	81% (N = 135)	79% (N = 117)
MD	99% (N = 69)	87% (N = 62)	87% (N = 47)
MD/PhD	91% (N = 328)	89% (N = 311)	78% (N = 262)
PhD	91% (N = 4406)	89% (N = 3966)	74% (N = 2891)
<u>Specialty</u>			
Anatomy	93% (N = 135)	92% (N = 107)	90% (N = 89)
Biochemistry	89% (N = 384)	86% (N = 297)	65% (N = 207)
Botany	92% (N = 252)	85% (N = 212)	79% (N = 161)
Cellular Biology	93% (N = 419)	88% (N = 425)	70% (N = 311)
Developmental Biology	90% (N = 155)	83% (N = 151)	76% (N = 118)
Ecology	88% (N = 889)	87% (N = 845)	73% (N = 613)
Genetics	92% (N = 545)	89% (N = 440)	75% (N = 290)
Molecular Biology	92% (N = 609)	89% (N = 601)	77% (N = 436)
Physiology	95% (N = 353)	89% (N = 352)	72% (N = 246)
Zoology	92% (N = 430)	91% (N = 297)	83% (N = 209)
Other	91% (N = 794)	90% (N = 764)	75% (N = 651)
<u>Abortion Stance</u>			
Very Pro-Choice	90% (N = 2838)	88% (N = 2625)	69% (N = 1932)
Pro-Choice	92% (N = 617)	88% (N = 562)	80% (N = 438)
Neutral	93% (N = 292)	88% (N = 276)	86% (N = 208)
Pro-Life	92% (N = 225)	91% (N = 204)	92% (N = 168)
Very Pro-Life	97% (N = 331)	92% (N = 311)	92% (N = 259)
<u>Ideological Stance</u>			
Very Liberal	91% (N = 1395)	89% (N = 1415)	70% (N = 1137)
Liberal	92% (N = 1065)	88% (N = 1054)	76% (N = 856)
Neutral	91% (N = 425)	86% (N = 435)	77% (N = 376)
Conservative	93% (N = 175)	93% (N = 178)	92% (N = 164)
Very Conservative	94% (N = 67)	99% (N = 70)	96% (N = 69)
<u>Political Stance</u>			
Strong Democrat	91% (N = 1516)	89% (N = 1533)	74% (N = 1238)
Democrat	91% (N = 783)	87% (N = 778)	72% (N = 623)
Neutral	91% (N = 469)	88% (N = 472)	78% (N = 411)
Republican	98% (N = 101)	93% (N = 106)	88% (N = 101)
Strong Republican	89% (N = 35)	97% (N = 37)	94% (N = 35)

Table 1 (continued)

Group	Q1 – Implicit A	Q2 – Implicit B	Q3 – Explicit
All Participants	91% (N = 4979)	88% (N = 4498)	75% (N = 3336)
<u>Religion</u>			
Agnostic	90% (N = 524)	88% (N = 573)	72% (N = 406)
Atheist	90% (N = 854)	90% (N = 857)	70% (N = 697)
No Religion	91% (N = 509)	85% (N = 508)	78% (N = 421)
Buddhist	86% (N = 43)	89% (N = 46)	78% (N = 40)
Hindu	96% (N = 27)	93% (N = 27)	81% (N = 26)
Muslim	95% (N = 22)	86% (N = 21)	89% (N = 19)
Jewish	93% (N = 110)	90% (N = 111)	68% (N = 90)
Lutheran	97% (N = 58)	89% (N = 57)	70% (N = 50)
Protestant	94% (N = 429)	90% (N = 435)	81% (N = 375)
Catholic	93% (N = 304)	91% (N = 308)	82% (N = 271)
Other	89% (N = 231)	86% (N = 227)	74% (N = 199)
<u>Language</u>			
Native English	92% (N = 2149)	89% (N = 2164)	73% (N = 1742)
Non-Native English	90% (N = 963)	87% (N = 973)	81% (N = 842)
<u>Gender</u>			
Male	92% (N = 2243)	89% (N = 2202)	77% (N = 1652)
Female	91% (N = 1414)	88% (N = 1332)	72% (N = 978)
<u>Marital Status</u>			
Single/Never Married	91% (N = 487)	86% (N = 452)	78% (N = 353)
Married	91% (N = 2999)	89% (N = 2744)	75% (N = 2017)
Widowed	95% (N = 57)	98% (N = 49)	72% (N = 43)
Divorced	94% (N = 281)	89% (N = 268)	71% (N = 202)
<u># of Children</u>			
0	90% (N = 1026)	88% (N = 940)	75% (N = 684)
1	91% (N = 676)	87% (N = 620)	73% (N = 440)
2	91% (N = 1492)	89% (N = 1381)	73% (N = 1042)
3	91% (N = 456)	88% (N = 417)	84% (N = 323)
4+	96% (N = 163)	88% (N = 144)	84% (N = 118)
<u>Annual Salary</u>			
\$25,000 and under	90% (N = 60)	95% (N = 59)	86% (N = 51)
\$25,000-\$49,999	87% (N = 328)	85% (N = 323)	80% (N = 256)
\$50,000-\$74,999	91% (N = 912)	88% (N = 852)	74% (N = 667)
\$75,000-\$99,999	92% (N = 847)	90% (N = 776)	78% (N = 566)
\$100,000-\$149,999	92% (N = 858)	88% (N = 772)	71% (N = 562)
\$150,000 and over	93% (N = 514)	89% (N = 465)	72% (N = 330)

In a combined measure of Q1-Q3, 95% of participants (5212 out of 5502; 99% CI [94.2%, 95.8%]) affirmed the biological view that ‘a human’s life begins at fertilization’ and 5% rejected the view (290 out of 5502) (Figure 4). This overall measure treated the statements in Q1-Q3 as logically and biologically equivalent statements of the biological view on when life begins. The overall consensus was established by coding participants in one of two ways: “affirmed the view” (i.e., participants affirmed at least one statement) or “rejected the view” (i.e., participants rejected at least one statement and did not affirm at least one statement).

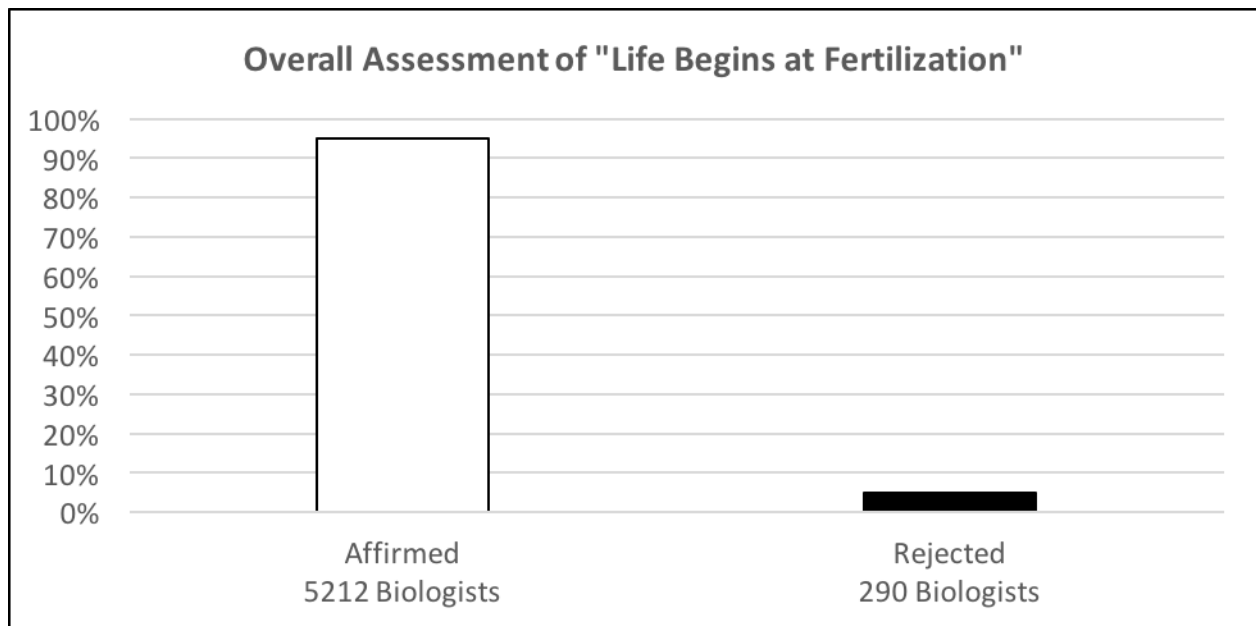


Figure 4. Participants’ overall assessments of the implicit and explicit statements on the biological view that ‘a human’s life begins at fertilization’.

Since biologists assessed a stated biological view in the previous measures, it was important to learn the views they would write about in an open-ended essay question. Again, despite Q4’s explicit descriptive frame (i.e., “[f]rom a biological perspective...”), the question’s use of certain language (e.g., “human”, “life begins”) could activate a normative interpretation. Most participants wrote about various points during pregnancy: when the sperm fertilizes the egg, when the zygote implants in the uterus, cell differentiation, neurogenesis, the first heartbeat, the first brain waves, the first pain response, fetal viability, and birth. Since a small percent of participants wrote about each of the various points after fertilization and before viability, they were grouped together and given the code “pre-viability”.

Altogether, responsive answers were given one of four codes: fertilization, pre-viability, fetal viability, and birth.⁴⁵ Consistent with biologists' descriptive view in Q1-Q3, a consensus of biologists wrote about the biological view that 'a human's life begins at fertilization' (68%; 1910 out of 2810) (Figure 5). Participants were separated based on their abortion stances to determine whether their abortion stances interfered with their biological stances. While there was some variance (e.g., fewer very pro-choice biologists (60%; 1052 out of 1739) wrote about fertilization than neutral (82%; 156 out of 190) or very pro-life biologists (89%; 231 out of 259)), a consensus of each group wrote that a fetus is biologically classified as a human at fertilization.

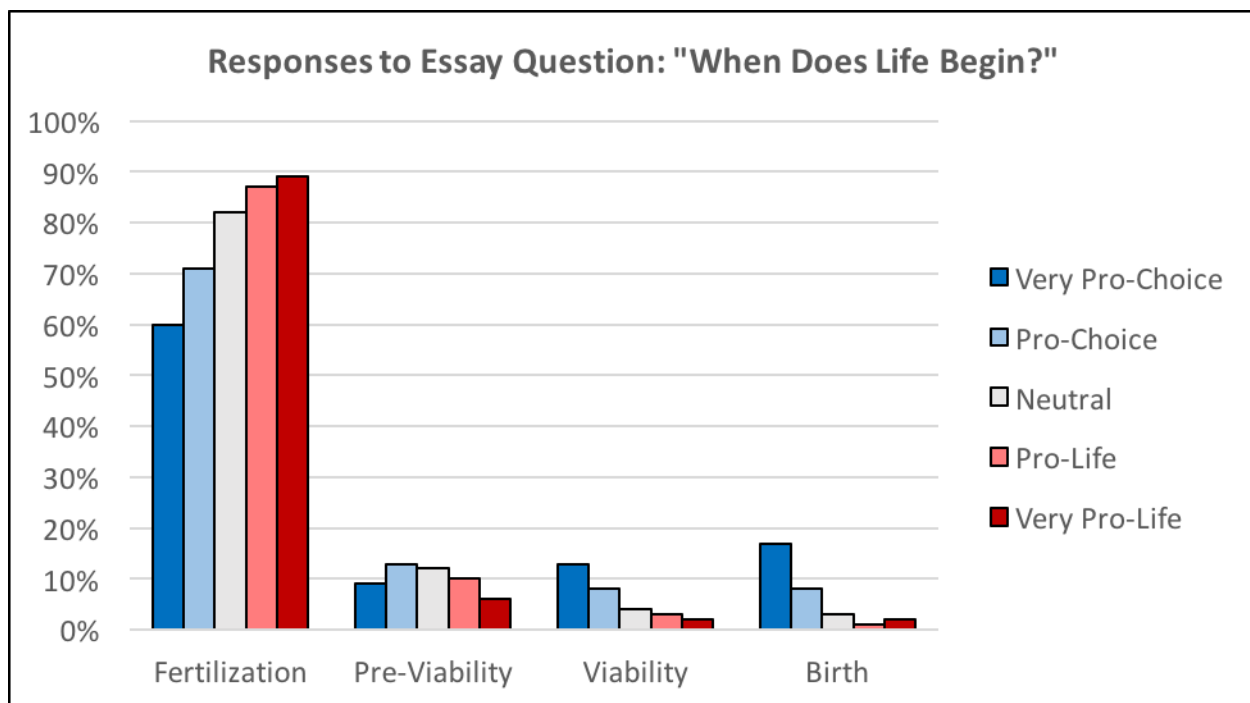


Figure 5. Participants' essay responses to the question, "From a biological perspective, how would you answer the question 'When does a human's life begin?'" Separated by participants' abortion stances.

Summary

Biologists' determination on the descriptive view of when a fetus is first classified as a human was explored in numerous ways. There was a consensus of biologists on all three statements that represented the view 'a human's life begins at fertilization'. When given an open-ended essay question that allowed participants to state how they'd determine when a human's life begins from a biological perspective, a consensus wrote about the same developmental landmark. Overall, the majority of the

⁴⁵ Nonresponsive answers did not represent a fetus' developmental point or state during pregnancy. Many of the nonresponsive answers focused on the beginning of 'human life' rather than 'a human life' (i.e., they argued life never really begins or ends, as it has continued in an unbroken chain from the first humans to today's humans).

study's large and broad sample of biologists held the descriptive view that a fetus is biologically classified as a human at fertilization.

Discussion

This paper demonstrates a large and robust scientific consensus on the biological view that 'a human's life begins at fertilization'. A consensus of biologists also wrote about this view in response to the open-ended essay question. Thus, in surveys of 5,502 biologists from 1,058 academic institutions around the world, there is a robust scientific consensus on when life begins. This finding will come as a surprise to many Americans. A recent Marist poll showed that 45% of Americans believe the statement "human life begins at conception" is a philosophical or religious belief.⁴⁶

While biologists' strong consensus support might be unexpected for some, it is expected given the underlying biology. Mammalian reproduction begins with the fusion of a male's sperm and a female's egg and results in a new mammalian organism. This new organism is a single cell called a 'zygote', and it is in the first stage of the mammalian life cycle. When a zygote is the result of a human sperm's fertilization of a human egg, the zygote has a human genome that is distinct from both of its parents.⁴⁷ Therefore, based on its biological classification, rooted in its genetics and development in the human life cycle, the zygote can be described as a *Homo sapiens sapiens* zygote (i.e., a human) to distinguish it from a *Felis catus* zygote (i.e., a cat).⁴⁸ This is not controversial. However, there has been some debate on the uniqueness of a human zygote compared to other human cells.⁴⁹

Through gene expression, human cells differentiate to perform specialized functions in the body. A zygote is unique as it is a totipotent cell that often becomes "a fertile, adult individual" through generating all cells of a body and organizing them "in a specific temporal and spatial sequence".⁵⁰ It is further unique in that it is the only single cell that is developing in the human life cycle. Accordingly, the biological stance on when a human's life begins would succinctly state: 'a human zygote is an organism with the human genome that is in the first stage of the human life cycle.' This is a descriptive

⁴⁶ "Americans' Opinions on Abortion". *Marist Poll*, 2018. Available at: <http://www.kofc.org/en/resources/communications/abortion-limits-favored.pdf>.

⁴⁷ Seisenberger, S. et al. "Reprogramming DNA methylation in the mammalian life cycle: building and breaking epigenetic barriers". *Phil. Trans. R. Soc.*, 2012.

⁴⁸ Wildman D.E., Goodman M. "Humankind's Place in a Phylogenetic Classification of Living Primates". In: Wasser S.P. (eds) *Evolutionary Theory and Processes: Modern Horizons*. Springer, 2004, p. 293.

⁴⁹ Anne, L. "Anti-Abortion Argument #1: It's a Person". *Love, Joy, Feminism*, 2012. Available at: <http://www.patheos.com/blogs/lovejoyfeminism/2012/09/arguments-against-abortion-its-a-person.html>.

⁵⁰ Condic, M. L. "Totipotency: What it is and what it is not". *Stem Cells and Development*, 2014, 23(8), p. 796-812. Available at: <https://doi.org/10.1089/scd.2013.0364>.

claim, based on observable traits⁵¹, that this paper’s findings suggest is a biological statement largely uncontested by the biological community.

This paper does not argue that the finding ‘a fetus *is* biologically classified as a human at fertilization’ necessitates the position ‘a fetus *ought* to be considered a person worthy of legal consideration’. The descriptive view does not dictate normative views on whether a fetus has rights, whether a fetus’ possible rights outweigh a woman’s reproductive rights, or whether a fetus deserves legal protection. However, presenting this view to Americans could facilitate such discussion. Resolving the factual dispute on ‘when life begins’ with biologists’ descriptive view could help parties focus on policy discussions related to the important ethical and legal issues of the U.S. abortion debate.

Future Directions

This line of inquiry’s obvious next step is to assess the impact of this paper’s primary finding on American participants’ thoughts on the U.S. abortion debate. Such research would shed light on modern Americans’ understanding of the relationship between descriptive and normative views of ‘when life begins’ and whether biologists’ consensus view suggests a fetus is worthy of legal consideration at fertilization. As previously discussed, these views might be fungible or inextricably linked for some people who might hold a traditional view or strictly support universal human rights principles⁵². However, the views might be unrelated for people who do not give legal consideration to humans they deem non-persons (e.g., zygotes, pre-viable fetuses, or infants⁵³) in favor of granting rights to non-humans they deem persons (e.g., orangutans⁵⁴, corporations⁵⁵, or sentient technology⁵⁶).

⁵¹ With recent technological advancements, biologists are now able to use observable genomic DNA to biologically classify a single-celled organism as a member of a species; modern biological classification methods make use of such genetic analyses in concert with classic methods that utilize morphological and phenotypical characteristics; see, for example: Kouduka, M., Sato, D., Komori, M. et al. “A Solution for Universal Classification of Species Based on Genomic DNA”. *International Journal of Plant Genomics*, Article ID 27894, 2007, 8 pages, Available at: <https://doi.org/10.1155/2007/27894>.

⁵² In Study 1, 96% (1105 out of 1152) agreed with the statement: “[a]ll humans deserve the right to life, religion, liberty, freedom, and other rights recognized as ‘human rights’”, and 97% (1113 out of 1153) agreed with the statement: “[a]ll humans are equally deserving of these rights regardless of their age, race, religion, or any other distinction.”

⁵³ Giubilini A. & Minerva F. “After-birth abortion: why should the baby live?”. *Journal of Medical Ethics*. Available at: <https://doi.org/10.1136/medethics-2011-100411>.

⁵⁴ Feltman, R. “Orangutan granted rights of personhood in Argentina”. *Washington Post*, 2014. Available at: https://www.washingtonpost.com/news/speaking-of-science/wp/2014/12/22/orangutan-granted-rights-of-personhood-in-argentina/?utm_term=.14ce55082cf0.

⁵⁵ Totenberg, N. “When Did Companies Become People? Excavating The Legal Evolution”. *NPR*, 2014. Available at: <https://www.npr.org/2014/07/28/335288388/when-did-companies-become-people-excavating-the-legal-evolution>.

⁵⁶ Morris, A. “We Need To Talk About Sentient Robots”. *Forbes*, 2018. Available at: <https://www.forbes.com/sites/andreamorris/2018/03/13/we-need-to-talk-about-sentient-robots/#66bb17e11b2c>.

This normative personhood view is perhaps most notably defended by Peter Singer, who has been recognized as one of the world's leading bioethicists since the 1970's.⁵⁷ He implicitly accepts the biological view that 'a human's life begins at fertilization', "there is no doubt that from the first moments of its existence an embryo conceived from human sperm and eggs is a human being"⁵⁸, but he finds this fact insufficient for a fetus' ethical and legal consideration. He argues that "the fact that a being is a human being, in the sense of a member of the species *Homo sapiens* [*sic*], is not relevant to the wrongness of killing it" and, instead, argues that rights should only be granted to human beings that have "characteristics like rationality, autonomy, and self-consciousness".⁵⁹ This stance represents the judgment that a fetus is not protectable in utero and abortion is not wrong because it does not end a person's life, as personhood is not achieved until some point in early childhood. Since his personhood perspective has made him the subject of recent backlash⁶⁰, it is not clear whether this normative view is a common or mainstream view.

American participants did not share Professor Singer's view. In Study 1, 89% of participants (985 out of 1108) suggested they believe life is protectable when it begins.⁶¹ However, this finding represents comparisons of participants' stances on when a human's life begins and their stances on when they believe a fetus is deserving of legal protection. This is a coarse measure. Nuanced questions would ascertain whether Americans agree that a fetus' life is worthy of legal consideration at fertilization after being presented biologists' consensus view. Some might agree, but others would likely disagree because they do not recognize a descriptive view as relevant to the normative view. People could also recognize a fetus as worthy of legal consideration but determine that a fetus' rights are secondary to women's liberty rights, precluding these people from considering fetuses worthy of legal protections.⁶² This paper's findings should be understood in the context of these perspectives.

⁵⁷ Singer, P. "The world's most famous utilitarian on whether all carnivorous animals should be killed". *Vox*, 2015. Available at: <https://www.vox.com/2015/6/18/8802755/peter-singer>.

⁵⁸ Singer, P. "Practical Ethics". Cambridge: *Cambridge University Press*, 1993, 2008, 2nd ed., p. 85-86.

⁵⁹ *Id.* at 175-217. Since Singer argues that "[i]nfants lack these characteristics. Killing them, therefore, cannot be equated with killing normal human beings, or any other self-conscious beings", this position advances the normative view that abortion cannot be equated with homicides of post-birth humans and suggests fetuses are not worthy of legal protection.

⁶⁰ Chasmar, J. "Princeton bioethics professor faces calls for resignation over infanticide support". *Washington Times*, 2015. Available at: <https://www.washingtontimes.com/news/2015/jun/16/peter-singer-princeton-bioethics-professor-faces-c/>.

⁶¹ Participants were asked when they believed life begins and when it is protectable. Each of their responses were coded as "before viability", "viability", and "after viability". Their responses were then compared and coded as "before life begins", "when life begins", or "after life begins".

⁶² In her philosophical defense of abortion, Judith Jarvis Thomson famously posed a thought experiment related to abortion in which she argued that, while a fetus very well might be deserving of rights, a woman's right to autonomy outweighs the fetus' rights. Thomson, J. J. "A defense of abortion". *Philosophy and Public Affairs*, 1971, 1(1), p. 47-66.

Ostensibly, this paper represents pre-mediation discovery. This research began with mediated discussions on abortion with pro-choice and pro-life law students, in which parties often spent most of the time debating when life begins. Parties would often circle back to that factual dispute when the mediator would try to stimulate discussion on policy issues by helping both sides talk through their interests in the U.S. abortion debate. The mediated discussions suggested there is too much vehement disagreement on the descriptive view on ‘when life begins’ for parties to have productive policy discussions.

Abortion polls of Americans, the legal history of the U.S. abortion debate, and the preliminary mediated discussions with law students all suggest that the dispute on when life begins needs to be resolved. While the studies in this paper should be replicated⁶³ to fully resolve the dispute, the findings suggest the resolution would entail the descriptive view: ‘a fetus is biologically classified as a human at fertilization’. Americans could then stop arguing about when a fetus *is* a human and start discussing when a fetus *ought* to be given legal consideration, which is the primary issue in U.S. abortion laws.

⁶³ As was suggested by the different affirmation rates between the implicit statements and the explicit statement, this line of inquiry requires a careful consideration of language. A replication study could have different findings if it employs questions that are likely to activate biologists’ normative interpretations of ‘when life begins’ (e.g., ‘if the Supreme Court wanted you to weigh in on when life begins, what would you say’, ‘is a zygote a human being’, ‘when does a person’s life begin’).