



# Human-Animal Chimeras:

## Unethical and Unnecessary

*by Mary Szoch, M.Ed.*

### Key Points

Human-animal chimeras are creatures that are part human and part animal. Since 1979, there has been a restriction, known as the 14-Day Rule, on developing this type of creature past 14 days gestation in vitro.

In 2016, after scientists gained the ability to develop an embryo in vitro beyond nine days, the National Institutes of Health revisited the 14-Day Rule, but under the pro-life Trump administration, the Rule was kept in place.

After a partnership with China created the first human-primate chimera, the NIH, under the Biden administration, opted to once again review the 14-Day Rule. Senators recently voted along party lines against banning the creation of human-animal chimeras through legislation.

In the United States, the ethical considerations regarding human-animal chimeras and human embryo research are intertwined. Understanding the regulations on human-animal chimeras the United States ought to have requires a review of the United States' policies on human embryo research, an overview of what human-animal chimeras are, an analysis of the purported benefits of human-animal chimera research, and a synopsis of the ethical questions posed by creating these creatures.

The serious ethical concerns about the creation of human-animal chimeras and the lack of any beneficial scientific advancements from chimera experiments make it clear that human-animal chimeras are unethical and unnecessary.

This report can be read online at [frc.org/chimeras](https://frc.org/chimeras)

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## **Human Embryo Research and the History of the 14-Day Rule**

In 1979, when making recommendations surrounding human embryo research, the Ethics Advisory Board of the now-defunct U.S. Department of Health, Education, and Welfare stated that human embryos should not “be sustained in vitro beyond the stage normally associated with the completion of implantation (14 days after fertilization).”<sup>1</sup> This controversial regulation, which led to the purposeful destruction of human embryos, became known as the “14-Day Rule.”

In 1984, the Warnock report from the United Kingdom also determined 14 days was the cut-off point for research developing embryos in vitro; however, this report justified the time limit by saying, “at this point in development embryos form the primitive streak, an easily observable early sign of embryo organization.”<sup>2</sup> The Warnock report considered 14 days the point at which an embryo became an individual.

Both justifications for the 14-Day Rule were arbitrary. By 1999, it was widely known that the implantation justification behind the 14-Day Rule was inaccurate and an over-estimation of the amount of time it takes for implantation to take place. Additionally, even if implantation did occur at 14 days, implantation merely changes the location of the human embryo, which has no bearing on its moral status. The Warnock report’s basis for the 14-Day Rule was equally nonsensical. From the moment of conception, the embryo is a unique human organism containing the DNA blueprint that remains consistent for the person’s entire life, making the 14-day mark a completely random time marker.

Despite the 14-Day Rule’s lack of a scientific foundation, it was not until 2016 that the United States first revisited the rule.<sup>34</sup> Unfortunately—though unsurprisingly in a nation that allows abortion up until birth—those leading the charge to change the 14-Day Rule desired to lengthen, not shorten, the timeline.

Prior to 2016, the 14-Day Rule was not a major point of contention because up until that point, scientists were unable to sustain an embryo in vitro past nine days.<sup>5</sup> When scientists first broke the

nine-day barrier in 2016, the National Institutes of Health (NIH) revisited the limitation on embryo development in vitro—proving that the 14-Day Rule was simply an arbitrary marker allowing scientists to advance to the point science allowed while simultaneously professing that there were ethical limits to the research. Though the NIH did solicit comments in 2016, the 14-Day Rule ultimately remained in place under the pro-life Trump administration.

## **Scientific Advances Call the 14-Day Rule into Question**

As science has advanced and the ability to sustain an embryo in a lab dish approaching 14 days has developed, scientists' desire to “grow” an embryo beyond that point has expanded as well. For human beings, 14 days after fertilization is the point at which gastrulation—the movement and specialization of cells into three layers of precursors for distinct cell types that eventually form the brain, skin, lungs, and other organs—occurs.<sup>6</sup>

From 1970 until the early 2000s, ethical concerns surrounding the destruction of human embryos dominated the conversation regarding human embryo research.<sup>7</sup> However, in 2007, the Japanese researcher Shinya Yamanaka discovered the ability to reverse-engineer cells back to the pluripotent stage—in other words, these cells were reverse-engineered to the point where they could now be used to produce any type of cell in the body except the placenta.<sup>8</sup> It should be noted that the use of these pluripotent cells is not without ethical concerns. If used in creating a human-animal chimera, these pluripotent human cells could grow faster than the animal cells, resulting in an embryo solely or mostly composed of human embryonic cells.<sup>9</sup> Both the creation and destruction of this type of embryo are problematic.

Although the 14-Day Rule and the lack of scientific advancement in the field have prevented scientists from sustaining human embryos past the 14-day mark, Yamanaka's discovery and the lack of truly ethical guidelines has opened the door for merging reverse-engineered human cells with animal embryos, most recently with a primate embryo to create a half-human, half-primate and to study this organism's development.<sup>10</sup> This half-human, half-animal creature is known as a human-animal chimera.

In the United States, the National Institutes of Health (NIH) has had a moratorium in place since 2015 that prohibits federal funding for this type of human-animal chimera. Because of the ban on federal funding, Juan Carlos Izpisua Belmonte, the first scientist to successfully produce a human-monkey chimera, sought and received funding from private foundations and the state-funded California Institute for Regenerative Medicine. He partnered with Weizhi Ji at Primate Biomedical Research in Kunming, China, to first cultivate monkey embryos in vitro to 20 days—just before gastrulation takes places in monkeys.<sup>11</sup>

After affirming that a monkey embryo could survive up to 20 days outside the womb, beginning in 2019, Belmonte worked to introduce the reverse-engineered pluripotent human stem cells into the monkey, creating a human-monkey chimera.

## **What Is a Chimera?**

A chimera is an organism made of two different sets of DNA from two different organisms that did not sexually reproduce. In other words, the two organisms are merged into one creature.<sup>12</sup>

The organisms whose DNA is contained in the chimera can be of the same or different species. Single species chimeras are actually quite common. Bone marrow transplant recipients and fraternal twins (where one child dies very early in the pregnancy and whose cells are absorbed by the other twin) all have two sets of cells—their own and the cells from the donor or twin.<sup>13</sup> The most well-known chimeras, however, are known as “Mom.”

Whenever a woman is pregnant, some of the cells of her unborn child travel from the placenta, through the bloodstream, and into the woman’s body, where they may stay her entire life.<sup>14</sup> Cells from a mother’s children have been found in many organs throughout the body, including the brain.

Single species chimeras are not controversial and do not pose ethical concerns. Human-animal chimeras, on the other hand, do.

## **U.S. Prohibition on Human-Animal Chimeras**

The NIH currently prohibits the creation of chimeras by means of introducing human pluripotent cells into nonhuman primates or breeding animals where the introduction of human pluripotent cells may contribute to the germline (sperm or egg creation). This U.S. prohibition is why Belmonte partnered with Primate Biomedical Research in China to do this research.<sup>15</sup>

## **Advances in Human-Animal Chimeras Call the Prohibition on Them into Question**

The joint Belmonte-Ji experiment was “successful,” although not overwhelmingly so. Three of the embryos Belmonte created by merging monkey and human cells survived to day 19—five days past gastrulation in human beings. This means the human cells injected into the monkey had five days to differentiate into various human organs.

Following the Belmonte-Ji experiment, the International Society for Stem Cell Research (ISSCR), an international non-profit that promotes stem cell science, issued new guidelines to “address the recent scientific advances involving embryos, stem cell-based embryo models, chimeras, organoids, and genome editing.”<sup>16</sup> One of the ISSCR’s recommendations is to remove the 14-day limit on embryo development. Another is to allow “incremental” human-animal chimera research, which the ISSCR claims should “stop at well-defined timepoints to assess the degree and scope of chimerism during the development before proceeding to full gestation...Researchers should endeavor to use targeted chimerism strategies to a particular organ system or region of the gestating chimeric animal.”

Although most people find the potential of a monkey with a human brain (or a humanoid with a monkey brain) terrifying, the ISSCR’s recommended guidelines would allow scientists to create just that. The departure from the ban on human-animal chimeras and their decision to completely remove any limitation whatsoever with regard to human-chimerical animal research demonstrates that the ISSCR’s question is not, “should we” but “can we.”

## **Will Human-Animal Chimeras Likely Benefit Human Beings?**

Juan Carlos Izpisua Belmonte claims that he does not wish to create human organs in a monkey but simply study the “language” of early human embryo development to understand how diseases progress and, eventually, to use other animals—like pigs—to grow human tissue for organ transplants.<sup>17</sup> This desire sounds altruistic, but there is very little evidence that this type of research would actually yield positive results for humans. Meanwhile, there are ample ethical questions that should prevent this research from going forward.

For years, scientists have researched animals injected with human stem cells, which are a form of human-animal chimera, though not one developed from the embryonic stage. For example, scientists have grafted various human disease genes or cells into immune-deficient mice allowing scientists to study the effectiveness of various forms of treatment.<sup>18</sup> Though scientists have been able to cure human diseases in mice, most of these treatments—including all successful treatments for Alzheimer’s in mice—have failed miserably in humans largely because of the major differences between mice and human beings.<sup>19</sup>

Furthermore, the development of a disease in a human is the result of various factors—including a person’s genetic makeup, environment, and diet. Those factors cannot be reproduced in a human-animal chimeric fetus. It is not likely that the development of disease in a human-animal chimera would demonstrate anything other than the development of a disease in a human-animal chimera.<sup>20</sup> Like the inability to glean anything useful from the treatment studies done on mice, it is unlikely that scientists will find anything useful from studying the development of diseases in human-animal chimeras.

## **Ethical Questions Posed by Human-Animal Chimeras**

The ethical questions posed by creating an entirely new creature are significant. Is this new creature classified as a human, animal, or both? Which human organs determine that classification? Will this creature feel pain? If so, when? Will this creature be self-aware? If so, at what point? Is it ethical to

create an organism that has some human characteristics only for the purpose of studying it and using its parts? All of these questions have implications for how scientists should proceed. At this point, it seems impossible to answer any of them, and creating these creatures puts human beings in a position of causing grave moral harm.

Clearly, China—one of the greatest human rights violators of this era—does not share the United States’ emphasis and concern over whether scientific experimentation is ethically performed. In 2018, in an article regarding the ethics of animal testing, Weizhi Ji, the Director of Primate Biomedical Research who partnered with Belmonte to create the first human-monkey chimera, told the *Global Times* that “Ethics should not be a reason that hinders scientific development.”<sup>21</sup>

## **Efforts to Ban Human-Animal Chimeras**

In recognition of the pressure on the American government to allow for the creation of chimeras, and in an effort to safeguard Americans from unethical experimentation, Senator Mike Braun (R-Ind.) introduced an amendment on the Senate floor that prohibited creating certain types of interspecies chimeras—specifically human-animal chimeras.

It is important to note that Senator Braun’s amendment does not prohibit every type of chimera. It would be virtually impossible to do so, as many chimeras are naturally occurring, and in fact, part of the human species flourishing. Senator Braun’s amendment simply prohibits human-animal chimeras that are manufactured in certain ways, including:

- introducing nonhuman cells into a human embryo
- fertilizing a human egg with nonhuman sperm
- fertilizing a nonhuman egg with human sperm
- introducing a nonhuman nucleus into a human egg
- introducing a human nucleus into a nonhuman egg
- creating an embryo containing at least half-human and nonhuman chromosomes
- creating a nonhuman organism that is engineered to develop human sperm and eggs

- creating a nonhuman life that contains a human brain or predominately human brain
- creating a nonhuman organism that exhibits human facial features
- creating an embryo that:
  - is a mixture of human and nonhuman cells;
  - will develop human sperm and eggs and contain a human or predominately human brain; or
  - will exhibit human facial features.

This legislative effort failed to pass, with senators voting 49-48 against the amendment along party lines (Republicans for the prohibition; Democrats against it). Senators Marsha Blackburn (R-Tenn.), Joe Manchin (D-W.Va.), and Thom Tillis (R-N.C.) abstained.<sup>22</sup> Notably, so-called “pro-life” Senator Bob Casey (D-Pa.) voted against the prohibition, once again signaling that he does not value the lives of the unborn.

## **Conclusion**

For now, as the NIH ban on funding for this type of research currently remains in place, the Biden administration’s action with regards to human-animal chimeras remains to be seen. The creation of these creatures is fraught with unanswerable ethical questions. NIH’s statement that the ISSCR’s recommendations, which fail to take any of the ethical concerns into account, “has given us many points to consider” and that the agency will look to the ISSCR guidelines “to ensure our position reflects input from the community” is troubling.<sup>23</sup> It is time for Americans to ask, not “can we,” but “should we” blur the distinction between human beings and animals? The answer is no. Americans must demand policies from the government that reflect this position.

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<sup>19</sup> Sam Zimmerman, “Why Drugs Tested in Mice Fail in Human Clinical Trials,” *Science in the News*, Harvard University Graduate School of Arts and Sciences, February 11, 2020, accessed June 14, 2021, <https://sitn.hms.harvard.edu/flash/2020/why-drugs-tested-in-mice-fail-in-human-clinical-trials/>.

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<sup>22</sup> “Roll Call Vote 117th Congress - 1st Session,” United States Senate, January 16, 2020, accessed June 14, 2021, [https://www.senate.gov/legislative/LIS/roll\\_call\\_lists/roll\\_call\\_vote\\_cfm.cfm?congress=117&session=1&vote=00212](https://www.senate.gov/legislative/LIS/roll_call_lists/roll_call_vote_cfm.cfm?congress=117&session=1&vote=00212).

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