

Human/ Animal Chimeras: Science, Ethics, and Politics

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A chimera is an organism containing genes of two animals from genetically distinct populations, named for the Greek mythological creature with the head of a lion, the body of a goat, and the tail of a snake.

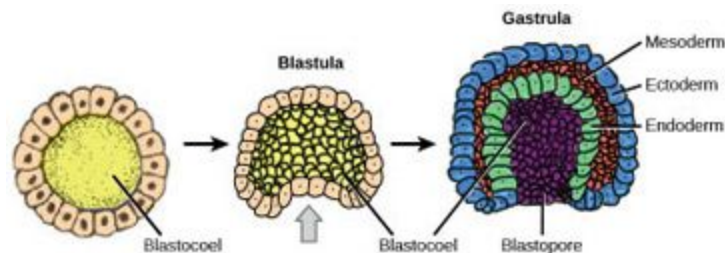


Scientists have been creating chimeras from nonhuman animals since the 1960's: combining species of mice, chicks with quails, and dual species of monkeys. New technology which makes gene editing easier inspires an interest in human/animal chimeras. Researchers dream of feats such as growing human organs inside of pigs to help those in need of transplants.

Science of Chimeras

Creation of a human/animal chimera requires injecting human stem cells into the embryo of another species. Think of DNA as a cellular reference library: each cell of your body contains a copy of the entire library, but does not read it all. The cell contains chemical bookmarks which tell it where to begin and end reading. Very young embryonic stem cells do not yet have any bookmarks, so they can be directed to read any of the instructions for life. Stem cells from adults have had many of their bookmarks removed. (Stem cells are also called pluripotent cells because they have a plurality of potential.)

How and when can human cells be introduced into an animal embryo? After sperm and egg fuse, the new cell, the zygote, has to grow into a large number of cells with differing functions. First, it divides and reconfigures into a ball called a blastula (from the Greek "blastos" for "sprout"). When dividing, it deposits a copy of its entire DNA reference library into each new cell. Next, the cells arrange themselves into three layers. Each layer of cells now has a different biological destiny from those in other layers. Every cell still contains its own copy of the entire DNA reference library, but it no longer has access to all of the books. A type of chemical bookmark tells it which sets of instructions to keep open.¹



¹ Khan, Sal. "Early Embryogenesis: Cleavage, Blastulation, and Gastrulation." *Early Embryogenesis*. Khan Academy. www.khanacademy.org.

Human stem cells receive directions from the embryo into which they are injected. At the earliest stages, the embryo is just beginning to assign developmental directions to its cells.² This raises concerns that human cells injected at early stages could be assigned by the embryo to become brain cells, or sperm or egg, in the chimeric embryo. Would an animal with human brain cells differ in identity from an animal with a human kidney?

Ethics of Chimeras

In theory, the Catholic Church could accept human/animal chimeras under certain circumstances, providing the following ethical standards could be assured:³

1. There would be no killing of human embryos.
2. The human/animal chimera could not produce human sperm or eggs.
3. The chimera would not be given human cells with the potential to become part of the brain.

Politics of Chimeras

The National Institutes of Health, the federal government agency which funds half of all biomedical research in the U.S., currently bans funding for human/animal chimeras, but it is proposing to lift the ban.

Part of the NIH proposal supports the aforementioned ethics, and part opposes. NIH will accept public comments until September 4th, 2016. The proposal is described here:

<http://osp.od.nih.gov/under-the-poliscope/2016/08/next-steps-research-using-animal-embryos-containing-human-cells>

The first part of the proposal is as follows:

- a. "Human pluripotent cells are introduced into non-human vertebrate embryos, up through the end of the gastrulation stage": this means human cells would be introduced early enough to potentially become part of the brain, or sperm or egg.
- b. "Human cells are introduced into post-gastrulation non-human mammals (excluding rodents), such that **there could be either a substantial contribution or a substantial functional modification to the animal brain by the human cells.**"

Our analysis:

a. We oppose this. Human pluripotent (stem) cells should not be introduced into the embryo in these early stages. This would increase risk of human cells being incorporated into the brain or gametes of the animal embryo. We must ensure a sharp demarcation between human and animal organisms by guarding against commingling of human and animal components in the brain, since it is the physical seat of consciousness. Additionally, we oppose any use of human embryonic stem cells since that would require the taking of a human life.

b. We oppose this as well. Again, we must avoid integration of human and animal components in the brain, the physical platform for consciousness. We further oppose any use of human embryonic stem cells since that would require the destruction of human life.

The second part of the proposal is as follows:

² Khan, Sal. "Embryonic Stem Cells." *Biotechnology*. Khan Academy. www.khanacademy.org.

³ Pacholczyk, Fr. Tad. "Human Organs from Pigs: Is it Kosher?" *Making Sense of Bioethics*. Catholic Herald. 10 March 2016.

- 1) "Expand the existing prohibition on introducing human pluripotent stem cells into blastocyst stage nonhuman primate embryos to include pre-blastocyst stage nonhuman primate embryos." Human cell introduction would be at a later developmental stage of the animal embryo.
- 2) "Expand the prohibition on research involving the breeding of animals where the introduction of hESCs or human induced pluripotent stem cells may contribute to the germ line to include any human cells that may result in the formation of human gametes." This means that any human cells-- not only stem cells-- which might contribute to human sperm and egg would be forbidden.

Our Analysis:

- 1) We support this proposal to narrow the developmental window during which human pluripotent cells may be introduced. This diminishes the likelihood that human cells will be incorporated into the brain or gametes of the animal embryo. However, we oppose the use of human embryonic cells, which would require the obliteration of a human life.
- 2) We support this proposal to expand the prohibition to prevent the introduction into an animal embryo of *any* human cells-- including, but not limited to, pluripotent cells-- which might result in the formation of human gametes. However, we oppose the use of human embryonic cells since that would require the taking of a human life.

Future Implications

Chimera research holds potential to cure disease, but we must insist upon ethical means. First, we must vigorously oppose the destruction of human embryos to provide stem cells for this work.

Second, we must insist upon a sharp line of biological demarcation between human beings and nonhuman animals. We must ensure that human cells introduced into animal embryos will not have potential to develop into the sperm and egg which will form the next generation. Moreover, they must not progress into any components of the "scaffolding of consciousness"⁴ As eminent political philosopher Francis Fukuyama has explained, our political rights are based on our equality.⁵ Human beings possess more political rights than animals due to our rational intellect: we can vote, make moral decisions, and be held accountable for our behavior. If human DNA imbues an animal with some of the biological framework necessary for a rational human type of consciousness, what kinds of legal rights and responsibilities will we need to give this new creature? How will the political landscape change if some animals truly are more equal than others?⁶ What type of moral responsibility will we bear toward such creatures?

You Can Affect the Outcome

The NIH will be accepting public comments on the aforementioned proposals until September 4th, 2016. <http://osp.od.nih.gov/under-the-poliscope/2016/08/next-steps-research-using-animal-embryos-containing-human-cells>.

The chimera of Greek mythology was a monster with fiery breath emanating from its nostrils. The modern chimera need not petrify us so. It is not a brute visited upon us by capricious gods, but a product of human choice. This gives us an opportunity: to choose according to the light of moral vision and keep our humanity intact.

⁴ Pacholczyk, Fr. Tad. "Human Organs from Pigs: Is it Kosher?" *Making Sense of Bioethics*. Catholic Herald. 10 March 2016.

⁵ Fukuyama, Francis. *Our Posthuman Future: Consequences of the Biotechnology Revolution*. New York: Picador, 2002.

⁶ Orwell, George. *Animal Farm*. Harcourt, Brace, and Company, 1946.

