Commentary

Nature Reports Stem Cells
Published online: 14 June 2007 | doi:10.1038/stemcells.2007.31

A theological argument for chimeras

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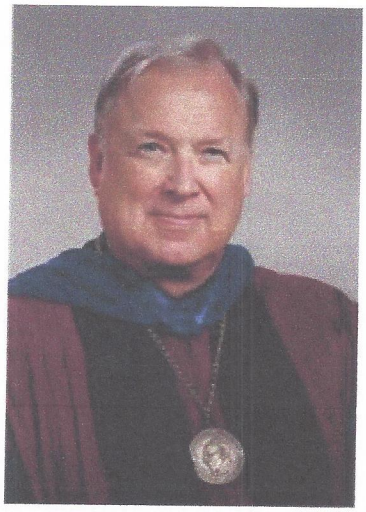
On what theological grounds would one protect the line between species?

If we place human embryonic stem (hES) cells into the brain tissue of a chimpanzee, might the chimp look us in the eye and say, "Thanks for the genetic enhancement. Now, where do I register to vote"?



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Stem cell researchers have not actually encountered this scenario. Yet, a foreboding caution surrounds stem cell research when protocols propose chimeras—a single organism with two or more genomes. An almost inchoate anxiety over human identity reacts with counterproposals to restrict gene mixing, especially mixing genes across species.

A chimera is a creature with DNA, cells, tissues or organs from two or more individuals. If the tissue comes from two different species, this produces an interspecific chimera. Chimeras are not produced through sexual reproduction, as hybrids are. Mules, born from a male donkey and a female horse, are hybrids, not chimeras.

Where do we draw the line between the human and the nonhuman? Mixing human and animal genes could create confusion, inviting moral chaos. When threatened by fear of moral chaos, some feel they can restore order by setting boundaries on research, by preventing our scientists from playing God in the laboratory.

Chimera Caution and Controversy

Human to human chimeras occur naturally. Mothers carry cells from past fetuses within their blood. When a double fertilization and fusion occurs, a baby could be born with two genomes. That person is a chimera. Most chimeric people live and die never realizing their double genetic identity.

Human to human chimeras can also be made. Kidney transplant patients carry two genomes. Leukemia patients who receive donor blood cell transplants become chimeric, now carrying the genetic codes of two persons.

Such chimerism does not seem to provoke moral confusion. Fear forms when animals mix with humans. Some fear the introduction of animal cytoplasm into the human body. Others fear that what was previously only an animal might take on human characteristics. Might the placing of human cells into a mouse brain lead to human-like cognitive functions? If so, would the line between us and them blur? Would theologians ask whether a humanized mouse or gorilla would grow a soul? This confusion is culturally discomforting.

This fear of moral confusion has surfaced in the United Kingdom, where the Human Fertilisation and Embryology Authority (HFEA) opened a public consultation regarding a proposal to permit scientists to use animal eggs to create

hybrid embryos from which embryonic stem cell lines will be produced.[1] Even if used only for research, such patient-specific stem cell lines could provide clues to therapy unobtainable by other means. Yet, ethical concerns have arisen, leading to caution and controversy.[2] (Although the Vatican and American evangelicals who have spoken out on the stem cell controversy work within the "embryo protection framework" and oppose the destruction of the *ex vivo* blastocyst, some Christians argue from within the "medical benefits framework" that such research should proceed on behalf of the health and well-being of future patients who could benefit from regenerative medicine. Jewish and Muslim spokespersons uniformly embrace hES cell research.)

The caution is apparent in guidelines for stem cell research published by the U.S. National Academy of Sciences in 2005. Its recommendations for human/nonhuman chimeras is enigmatic. "These kinds of studies could produce creatures in which the lines between human and nonhuman primates are blurred, a development that could threaten to undermine human dignity ... hES cells introduced into nonhuman hosts might be able to generate gametes, so any such human/nonhuman chimeras should not be allowed to breed."[3] Now, we might ask: why? Why would it be okay to place human DNA into an animal oocyte but not okay for it to breed? What might be going on beneath such a caution?

This caution becomes controversy when we go to Washington. In a 2005 bill introduced in the U.S. Senate (first S.659; then S.1373) known as the "Human Chimera Prohibition Act of 2005," Senator Brownback, author of this proposal, articulates an assumption: he upholds "respect for human dignity and the integrity of the human species." Ordinarily respect for human *dignity* applies to individual persons, not to our species. "Dignity" means each person should be treated as a moral end and not a means to something else. Is "dignity" here being understood as the "integrity of the human species"? Has this become a moral end? Has Senator Brownback committed the fallacy of composition, the fallacy of arguing from a property of a part (dignity for an individual person) to a property of the whole (dignity for the human species)?

What the Brownback bill implies is that the human species has become a moral end, and the way to maintain human integrity is to prevent human genes from becoming mixed with nonhuman tissue. The Senator wants to prevent chimeras that would "blur the lines between human and animal, male and female, parent and child, and one individual and another individual." This bill forbids research that involves placing a human DNA nucleus into an animal embryo, or an animal nucleus into a human embryo—exactly the experiments that researchers think necessary to know how a genome can be reset, the process through which human beings begin.

See commentary Man or Beast? Man and Beast! by Ian Wilmut, who led the team that cloned Dolly and now heads the Centre for Regenerative Medicine at the University of Edinburgh.

Perhaps out of fear that this bill would become law, in 2005 the National Academy of Sciences guidelines preserved the right to create chimeric cells and embryos while lowering the level of offense by preventing breeding. Without breeding, we could avoid creating individuals whose birth would raise the question: is this chimera human or not?

Human/NonHuman Chimerism

Cross-species chimerism is common in both research and therapy. Many animals now carry human cells and, in some cases, even human organs: cows secrete human protein in milk; pigs carry human blood; sheep are growing human liver and heart tissue; mouse brains contain human neurons; and we routinely place human tumor cells into animal models. Reversing the direction, some walking among us have pig- or cattle- derived valves in their hearts. In short,

stem cell research did not introduce chimerism to research or therapeutic protocols, but barring such chimerism would prevent significant experiments in stem cell research.

Some religious bioethicists want to prevent the mixing of species and, thereby, shut down this form of hES research. For example, in its "Prospects for Xenotransplantation" (implanting animal-grown parts into people) the Pontifical Academy for Life tries to protect human identity from the threat of chimerism. "The implantation of a foreign organ into a human body finds an ethical limit in the degree of change that it may entail in the identity of the person who receives it."[4] (Perhaps one might cite the ancient Hebrew proscription against bestiality.)

Similarly, the National Council of Churches in the United States has produced a policy statement. National Council of Churches theologians "oppose the creation of chimeras, or any experimentation that might lead to an intermediary human/animal species."[5] On what theological grounds would one want to protect the line between species? Scientific Creationists and some fundamentalists draw a sharp line between "kinds" (Genesis 1:10) and translate the biblical "kind" with "species". This is at best a tendentious and marginal position. Among mainline theologians, no biblical warrant would seem to draw such lines.

Such proscriptions make no scientific sense, because such a boundary between species does not exist. Now, one might counter: A species can be defined as a group of organisms that can reproduce, right? Well, yes, but this understanding of species contributes nothing to the field of genetics. New knowledge regarding the constancy of DNA shows the genetic continuity of all living things, and such thick lines of separation between species are fading away. If anything, molecular biologists are delighted that they can mix DNA among individuals within our human species and with nonhuman animals.

A second objection does not argue that species should remain pure, but rather that mixing human with nonhuman animals is unnatural. And, if it's unnatural, don't do it! There is a philosophical and theological problem with such an objection, however. Philosophically, to object to anything a scientist does as "unnatural" does not in itself provide a moral prohibition. It is a fallacy to argue from what we describe in nature to what we ought to prescribe scientists to do. Such an objection relies upon the naturalistic fallacy. In addition, theologically, such an objection presumes a naturalism—a belief that nature in its present and allegedly fixed or unchanging state is somehow sacred and ought not to be violated by laboratory technology. No scriptural warrant for Jews or Christians or even Muslims exists for such a view of nature. God is sacred, not nature. God is unchanging, not nature.

"It is a fallacy to argue from what we *describe* in nature to what we ought to *prescribe* scientists to do."

What is actually going on here? Perhaps the mixing of human genetic material with animal models elicits a sense of revulsion, a sense of repugnance. This is widely called the "yuck factor". Perhaps this sense of repugnance provides sufficient warrant to avoid making chimeric babies, to avoid reproduction of hybrid individuals. Such a public policy would be understandable. Yet, in my judgment, the yuck feeling provides insufficient warrant to shut down hES cell research, especially when it has a great deal of potential medical benefit. If chimeric research can be pressed into the service of advance in regenerative medicine, then ethicists must appeal to reason and not yuck when providing moral guidance.

Concluding Policy Recommendations

With these considerations in mind, I recommend we follow two policy directions. First, no action should be taken to proscribe chimerism in stem cell research. Rather, we should encourage hES research that attempts to make patient-specific human cells to study disease and to solve the problem of immune rejection when foreign cells are placed within a patient. These efforts seek medical benefits, a moral good. In light of this, objections on the basis of species mixing, unnatural manipulation and the "yuck factor" fall flat. hES cell research for therapeutic purposes should proceed.

Second, action could and perhaps should be taken to proscribe the creation of a hybrid species with reproductive capacity. Animals that could produce human gametes should be prevented from breeding and producing children. This implies that placing hES cells in an animal host where they could eventually produce germ cells or even lead to the birth of a hybrid creature should be closely monitored, if not outrightly prevented. The reasons to prohibit such breeding are weak, but sufficient. The reasons are that philosophical assumptions regarding the relationship between the brain and the mind and the soul remain untested empirically. It is not yet known whether combining human DNA with primate brain cells or those of any other animal could lead to humanized cognitive abilities. And this could lead to confusion over what constitutes a human person. In the meantime, perhaps the yuck factor should hold precautionary sway. When more is known, such a policy could be revised.

About the Author

Ted Peters is Professor of Systematic Theology at Pacific Lutheran Theological Seminary and the Graduate Theological Union in Berkeley, California, where he teaches bioethics along with other subjects relating science to religion. He is co-editor of *Theology and Science*. He currently serves as a member of the Scientific and Medical Accountability Standards working group of the California Institute for Regenerative Medicine (CIRM). Peters served as principal investigator for a research project funded by the National Institutes of Health (NIH) on "Theological and Ethical Questions Raised by the Human Genome Initiative" hosted at the Center for Theology and the Natural Sciences (CTNS) 1990–1994. He edited the findings of the CTNS-NIH project for publication in a multiauthor book titled, *Genetics: Issues of Social Justice* (Goshen, IN, 1998). He is author of *The Stem Cell Debate* (Fortress Press, MN, 2007), *Science, Theology, and Ethics* (Ashgate, Aldershot, UK, 2003), as well as *Playing God? Genetic Determinism and Human Freedom* (Routledge, Oxford, UK 2nd ed., 2002). As a member of the research team on the "Religion, Culture, and Family" project sponsored by the University of Chicago, he wrote *For the Love of Children: Genetic Technology and the Future of the Family* (Westminster John Knox Press, Louisville, KY, 1996). He has co-authored two books on the evolution controversy: *Can You Believe in God and Evolution?* (Abingdon Press, Nashville, TN 2006) and *Evolution from Creation to New Creation* (Abingdon Press, Nashville, TN 2003). He served as a member of the Ethics Advisory Board for the Geron Corporation, 1998–2002.

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