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## **Nonhuman Chimeras with Human Brain Cells**

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### **Abstract**

Many people find the notion of blending humans and nonhumans together to create animals whose brains are composed entirely of human brain cells disturbing. I argue that these moral qualms lack adequate justification. I consider a number of reasons for objecting to the creation of such chimeras and argue that none of these reasons withstand scrutiny. I argue that the only plausible objections to these chimeras would require that they possess morally significant properties that would be lacked by similar, non-chimeric animals, but that there is no good reason to think this would be the case.

### **Introduction**

Among the potentially beneficial uses of human stem cells is the creation of human-animal chimeras whose brains are composed partly, or perhaps entirely, of human brain cells.<sup>1</sup> Such chimeras facilitate research into a variety of neurophysiological diseases, such as Parkinson=s disease, Alzheimer=s disease, and others. I will argue that such research is generally ethically unproblematic.<sup>2</sup>

### **Initial Assumptions**

I will begin with several assumptions that certainly will not be accepted by everyone. The first is that, subject to certain reasonable constraints, it is ethically acceptable to perform similar research on normal animals. I am well aware that there are vociferous critics of research using animals in such ways. Perhaps those critics are correct, but I will assume here that they are not so as to isolate as much as possible a narrower moral issue. The second assumption I will make is that it would not be ethically troubling to create chimeras using non-human species. For example, if a mouse were created with bovine brain cells, this would not raise significant ethical red flags. It is only when human cells are involved that serious ethical worries are raised. This assumption, too, could, and perhaps should, be very easily rejected. Perhaps there could be environmentally disastrous consequences should such chimeras be released or escape into the wild. Or perhaps such a chimera might suffer from resultant abnormalities that would make its life miserable. Again, I will discount such worries for present purposes in order to target the specific question of whether there are legitimate moral concerns resulting from the crossing of boundaries between humans and other species. One more assumption that I need to make is that there is nothing problematic about using human stem cells in general. That is, I will assume that there are ethically acceptable ways of obtaining human stem cells (or, perhaps, if only they will do, human embryonic stem cells), so that the only questions to be considered, ethically speaking, concern how they may be used, and not whether they may be used at all.

The core ethical issue, then, concerns the moral significance of chimeras with human brain cells (hereafter Abrain chimeras@). Since the moral significance of a thing is a function of what morally significant properties it has, the permissibility of research on brain chimeras stands or falls on the question of whether brain chimeras have more morally significant properties (or have them to a greater degree) than non-chimeric animals.

## The Argument

The basic argument that I take to show the moral innocence of creating brain chimeras is this:

1. The creation of brain chimeras is morally objectionable only if there is good reason to think that brain chimeras would have greater moral significance than non-chimeric non-human animals, or there is good reason to think that the creation of brain chimeras would lead to morally bad consequences.

2. There is no good reason to think that brain chimeras would have greater moral significance than non-chimeric non-human animals.

3. There is no good reason to think that the creation of brain chimeras would lead to morally bad consequences.

4. Therefore, the creation of brain chimeras is morally unobjectionable.

In what follows, I will consider objections to each of the premises, and argue that those objections are not compelling.

## The First Premise

It is important to consider the first premise in light of the assumptions I have made at the outset. Once those assumptions have been granted, the only reasons to think there would be anything objectionable about creating brain chimeras would be in respect of their intrinsic moral properties, or in terms of morally relevant consequences. One possible objection to this might appeal to the possibility that brain chimeras might have *less* moral significance than non-chimeric animals. Perhaps brain chimeras would be defective in some way that impairs their moral significance, and one might wonder whether this is permissible. For example, it seems to be morally wrong deliberately to attempt to conceive a human child who would be born with

severe mental retardation. Could it not also be similarly wrong to breed a defective chimeric animal?

But I have been assuming that there is nothing morally objectionable, in general, about research performed on non-chimeric animals. If it would not be morally objectionable deliberately to breed a mouse with certain qualitative flaws that would confer upon it less moral significance than a normal mouse, then there will, likewise, be nothing objectionable about creating a brain chimera that would have comparably diminished moral significance. At best, one might be able to argue that creating some chimeric animals is wrong in the same ways and for the same reasons as comparable research involving non-chimeric animals.

A more serious objection is that the first premise puts entirely too much weight on consequences. My reply to this is to suggest that any plausible non-consequentialist moral principle that would show the creation of brain chimeras to be problematic would have to appeal to the morally significant properties of affected individuals. If this is right, then the first part of the consequent will handle any problematic cases that can't be evaluated in terms of morally bad consequences.

### **The Second Premise**

Much of the concern about brain chimeras derives from imagining them to be cognitively human-like. A mouse with human brain cells might exhibit cognitive and behavioral traits that are more human-like than mouse-like, similar to the fictional character AStuart Little.<sup>3</sup> It is not clear exactly what is problematic about this scenario. Is it the actual *creation* of such a creature that would be problematic? Or do moral problems arise only with respect to how such a creature would be *treated*? It is difficult to see how the former claim could be defended if the mouse were *Between the Species* VII August 2007 [www.cla.calpoly.edu/bts/](http://www.cla.calpoly.edu/bts/)

treated in, say, the manner the character Stuart Little is treated. Suppose that E.B. White's story, *Stuart Little*, had been a documentary rather than a fictional tale. Suppose, further, that Stuart was a brain chimera. Would it be appropriate to track down the researchers that had created Stuart and accuse them of having committed an egregious moral offense of some kind? Certainly Stuart, himself, would not think so. No more than human beings conceived through in vitro fertilization would have reason to lodge protests over the manner of their origination. It must be, then, that concerns over brain chimeras exhibiting human-like cognitive and behavioral traits pertain to the way such creatures might be treated. In other words, the concern is that their moral significance would not be appropriately respected. If, as I have assumed at the outset, there is nothing especially objectionable about the ways non-chimeric animals are treated, there will only be reasons to object to the treatment of chimeric animals if they should have morally significant properties that non-chimeric animals lack.

### **The Soul of a Chimera**

**Error! Bookmark not defined.** Although very few in the scientific community have serious concerns about whether or not research negatively impacts human souls, the same cannot be said regarding the general public. Perhaps a majority of North Americans believe that human beings possess an immortal soul that is crucially involved in conferring on human beings their moral significance. Many of the individuals who are empowered to make policy decisions most likely hold such a view. Accordingly, even if the view is false, it remains worthwhile to consider whether such a view is inconsistent with the creation of brain chimeras and relevantly similar research projects.

There are two reasons why the creation of brain chimeras should not worry those who  
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think human moral significance is tied to the possession of a soul.

The first reason is based on the putatively theological origins of souls. Most who believe in souls also believe they are conferred on human organisms by God. But God would have no good reason to confer a human soul on a brain chimera. Therefore, there is no reason to think that brain chimeras have any greater moral significance than normal animals.

The second reason is that it is increasingly apparent that even if a dualistic account of mind should turn out to be correct where not all human cognitive properties can be reduced to or explained in terms of neurophysiology, the vast majority of them can be. In particular, the ethically significant properties of humans that are at the center of most moral concerns are clearly grounded in human neurophysiology. Therefore, even if one believes that souls exist, the creation of brain chimeras will only be ethically troubling if there are good reasons to think that they would, in any significant way, have the sort of neurophysiological properties that are linked to moral significance in ways that are lacking in normal animals. I will argue below that there are no good reasons for thinking this to be the case.

### **Wonder tissue**

**Error! Bookmark not defined.** If humans have greater moral significance than other animals, it is plausible to hold that this heightened moral significance is due to the morally significant properties that the human brain makes possible. One concern that many people may have in response to the possibility of creating brain chimeras is that the brain chimeras might, in virtue of having human brain tissue, also exhibit some of the same morally significant properties that normal humans exhibit. There is little reason to think that this would be the case, however.

There is nothing morally special, from a biological point of view, about human brain  
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cells. A single human brain cell, or for that matter even a fairly large cluster of such cells, existing in functional isolation from the rest of a human brain, is as much devoid of moral significance as would be a cluster of brain cells from any other sort of creature. To treat human brain cells as though they would somehow confer upon brain chimeras a full complement of human cognitive traits is to treat human brain cells as though they constituted a sort of what Daniel Dennett has called Awonder tissue@.<sup>4</sup>

Suppose a researcher were to cultivate a colony of human brain cells and attempted to get them to grow in a particular configuration. This could have potentially valuable applications. Suppose the researcher decided to attempt to grow the cells in a pattern resembling a >+= sign. It would be a poor objection to this research project that the configuration of brain cells might possess human-like cognitive properties that were morally significant. There is no reason at all to suppose that the >+= -shaped configuration of cells would have any such properties merely because they were *human* brain cells. Human brain cells are not wonder tissue. Whatever morally significant properties humans have as a result of their brains is not simply a result of the peculiar biology of human brain cells. Rather, it is the functional organization of human brain cells that makes the difference. So far, the evidence suggests that in creating brain chimeras, human brain cells are adapted into the patterns of functional organization that would be expected not of humans, but of mice (and we would expect similar results in other species).<sup>5</sup>

Having said this, however, I do think it would be problematic to create a chimera with non-human brain cells but human functional organization. This is not because there is any good reason to think that such a creature would be morally less significant in light of the genetic properties of the cells, but rather because there is some reason to worry that such a chimera

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would not develop normally. I do not think that this implies that there is serious reason to think that non-human animals with human brain cells might also fail to develop normally, only in ways that would confer upon them enhanced moral significance. There are probably too many factors that would prevent such brain chimeras from developing the kinds of cognitive traits that would raise moral concerns.

## **Playing God**

Another popular complaint is that researchers who create brain chimeras is a case of *Playing God*. This is not really an objection, however, since use of the expression *Playing God* clearly shows that it functions entirely as a way of suggesting that someone is doing something that only God should do. It amounts, therefore, to mere assertion. To say that the creation of brain chimeras is *playing God* is nothing more than to say that researchers are doing something that only God should do. No argument is offered as to why only God should be doing it. There is no real objection here B only an expression of moral discomfort without explanation.

Of course, it is possible that one could try to mount a more complex argument here by appealing to a general principle to the effect that humans ought never to interfere with the workings of nature, or perhaps of biological nature, in particular. There is little plausibility in this, however, as it would clearly rule out as illegitimate all sorts of medical and scientific progress that involves doing exactly that.

A still more sophisticated objection would involve attributing to nature a divinely-instituted teleology. Biological nature has, on this view, an inherent teleology with which it is wrong to interfere. According to this view, to *play God* is to perform actions that go against the natural order that has been divinely established.<sup>6</sup>

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There are two primary replies to this argument from natural teleology. The first is to argue that it would rule out too many forms of behavior that do not seem at all morally problematic. For example, one might argue that it appears inconsistent with natural teleology to build machines that allow humans to fly, to administer an anticoagulant, or to attempt to preserve an endangered species by isolating it from its natural predators. Humans routinely perform many actions that would appear to be at odds with natural teleology. A response to this might be to attempt to hold that promoting the good of humanity by a variety of artificial measures is, in fact, consistent with natural teleology. But if one takes this route, it is difficult to see why the administration of an anticoagulant is morally acceptable but the creation of brain chimeras is not, if the latter activity should turn out to contribute to promoting the good of humanity.

A second response to arguments from natural teleology is simply to argue that such views have been supplanted by an evolutionary naturalism according to which things in nature do not aim at any divinely ordained patterns. Moral value is not something that is built into the natural order by God, but rather is brought to it by us. This is a more difficult approach to defend, since it depends on a defense of a thoroughly naturalistic world view. Nevertheless, I believe there are good reasons to think that this is, in fact, the correct view. However, it is too ambitious a project to offer a defense of this point here. Furthermore, a defense of creating brain chimeras that relies on a thoroughly naturalistic world view is not likely to find many in the general public, or among policy makers, who would receive it well. It would, therefore, be more strategically prudent to produce a defense that is at least neutral with respect to the naturalistic hypothesis.

### **The Third Premise - Consequences**

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Still another line of argument against the creation of brain chimeras is that allowing such research to go forward opens the door for other research that would be more clearly troubling. For example, a brain chimera in which non-human embryonic stem cells were used to create a human whose brain consisted of non-human brain cells appears to be ethically troubling. Such a brain chimera would most likely exhibit the sort of functional organization that would give rise to the right sort of morally significant cognitive properties that we should worry about. Still another problematic case might be the creation of whole-creature human-non-human chimeras, such as, for example, a human-chimpanzee chimera. We can call this kind of scenario the *Ahumanzee* scenario.<sup>7</sup>

However troubling the *humanzee* scenario might be, I do not think it affects the question of whether or not the creation of brain chimeras is, in general, ethically problematic. In the first place, concerns that *humanzee*-type scenarios might come about can already be raised by the fact that cross-species chimeras have in fact been created.<sup>8</sup> More importantly, however, it seems a poor rule that an ethically acceptable action should be prohibited because it *might* lead to an ethically unacceptable action. It has to be the case that it is at least highly likely that the acceptable action will lead to the unacceptable action for this sort of slippery slope argument to have any plausibility. However, there is no good reason at all to think that the creation of brain chimeras is any more likely to lead to *humanzee*-type scenarios than is any of the many other genetic manipulation techniques that are already in use.

Another objection is that the creation of some chimeras, perhaps especially certain kinds of brain chimeras, might lead to beings possessing indeterminate moral status. Such an objection has been raised by Richard Doerflinger, who opined, “I think it would be basically immoral to *Between the Species* VII August 2007 [www.cla.calpoly.edu/bts/](http://www.cla.calpoly.edu/bts/)

create a human whose status we could not determine. We=d have an unresolvable moral dilemma about how to treat this animal.”<sup>9</sup> One problem with Doerflinger=s objection is that there are already creatures whose moral status is difficult to determine. This is one of the factors that generates so much disagreement over abortion, euthanasia. While some people see early embryos as nearly devoid of moral significance,<sup>10</sup> others see them as having the same moral status as normal adults.<sup>11</sup> Similar apparently intractable disagreements exist regarding the moral status of humans in Persistent Vegetative States, and regarding the moral status of non-human animals. I suggest that although the creation of some kinds of chimeras may generate new cases over which moral disagreement will surely exist, this does not constitute reason to prohibit the creation of all chimeras. In the first place, there are some chimeras whose moral status is certainly no more problematic than the breeding of normal animals B this is, I think, the case with brain chimeras exhibiting the sort of functional organization of brain cells typical for non-chimeric animals of that type. In the second place, I think there is a compelling argument for the principle that holds that moral significance must be judged to be a function of morally significant properties, and this strongly suggests, I think, that some of the apparently intractable disagreements over moral status are in fact resolvable in principle. Such resolution would, of course, require significant revision or abandonment of many traditional ethical beliefs, but I see this as positive moral progress.<sup>12</sup> It is progress, for instance, to abandon a belief in fixed biological species and the often attendant belief that only members of the species *homo sapiens* possess moral significance. Recognizing that moral significance is a function not of species membership, but of morally significant properties dissolves many otherwise troubling moral questions, though, admittedly, it creates others. Even so, it is better to have to resolve moral

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problems that stem from a correct moral perspective than an incorrect one.

This perspective also provides a response to the claim by Jason Scott Robert and Françoise Baylis that:

All things considered, the engineering of creatures that are part human and part nonhuman animal is objectionable because the existence of such beings would introduce inexorable moral confusion in our existing relationships with nonhuman animals and in our future relationships with part-human hybrids and chimeras.<sup>13</sup>

First off, it isn't clear that the confusion such cases would introduce is, in all cases, necessarily inexorable. Furthermore, even if it is true that some action type generates moral confusion, that doesn't necessarily mean that it is immoral to perform actions of that type. We cannot plausibly endorse a general rule that says that an action is wrong wherever performing it would generate moral confusion (or even inexorable moral confusion). For example, many medical technologies make it possible to keep people alive who previously would have died. In many cases, the availability of these technologies creates significant moral confusion regarding their use or their discontinuation. Few people, however, would accept that such confusion constitutes good reasons not to develop or employ these technologies in at least some cases.

The creation of chimeras having human brain cells is no more ethically troubling than is research involving non-chimeric animals of the relevant type, since there is no compelling reason for thinking that such animals would possess any greater moral significance than the non-chimeric animals. It is a mistake to think that there is anything morally special about genetically human cells apart from the ways in which they can be functionally organized so as to ground morally significant properties of whole organisms. If research on the non-chimeric animals is *Between the Species* VII August 2007 [www.cla.calpoly.edu/bts/](http://www.cla.calpoly.edu/bts/)

morally permissible, so, too, would be research using morally comparable chimeras.

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1 See, for example, Sharon Begley, "Science Journal: Chimeras Exist, What If Some Turn out Too Human?," Post-Gazette May 06 2005.

2 Many of the arguments here could also be extended to apply to other problems in bioethics.

3 See, for example, James Langton, "Scientists to Make 'Stuart Little' Mouse with the Brain of a Human," The Telegraph Newspaper Online June 6 2005. Available:

<http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2005/03/06/wmouse06.xml&sSheet=/news/2005/03/06/ixnewstop.html>, October 27, 2006.

4 Daniel Dennett, Consciousness Explained (Boston: Little Brown & Company, 1991).

5 See, for example, Alysson R. Muotri and et al., "A Development of Functional Human Embryonic Stem Cell-Derived Neurons in Mouse Brain," Proceedings of the National Academy of Sciences 102.51 (2005).

6 Such a view is broadly implied by Natural Law theories like those of Aquinas. (See, for example, R.A. Armstrong, Primary and Secondary Precepts in Thomistic Natural Law Teaching (The Hague: Martinus Nijhoff, 1966).)

7 See, for example, Wikipedia - Humanzee, Available: <http://en.wikipedia.org/wiki/Humanzee>, November 28, 2006.

8 For example, Wikipedia - Sheep-Goat Chimera, Available: <http://en.wikipedia.org/wiki/Geep>, November 26, 2006.

9 In Carolyn Y. Johnson, "Blending of Species Raises Ethical Issues," International Herald Tribune April 21 2005.

10 See, for example, Mary Anne Warren, "On the Moral and Legal Status of Abortion," The Monist 57.4 (1973).

11 See, for example, Charles Swindoll, "Sanctity of Life: The Inescapable Issue," (Word Publishing, 1990) Available: <http://www.ccel.us/Swindoll.toc.html>, November 28, 2006.

12 In taking this position I put myself in the company of, for example, Peter Singer, Rethinking Life and Between the Species VII August 2007 [www.cla.calpoly.edu/bts/](http://www.cla.calpoly.edu/bts/)

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Death: The Collapse of Our Traditional Ethics (New York: St. Martin's Press, 1995).

13 Jason Scott Robert and Françoise Baylis, "Crossing Species Boundaries," The American Journal of Bioethics (2003), vol. 3., p. 9