The Once and Future "Apeman"

Chimeras, Human Evolution, and Disciplinary Coherence

by Joseph S. Alter

Many have argued that anthropology, as a four-field discipline, lacks intellectual coherence. Recent developments in the field of biotechnology and the possibility of producing chimeras with recognizable human characteristics make it necessary to think in terms of a new kind of "old" four-field holism. The production of a human/nonhuman chimera raises theoretical questions about the nature of the species barrier in human evolution and about the larger philosophical question of the relationship between humans and nonhuman animals. Engaging with these questions provides critical perspective on the evolution of *Homo sapiens* and on the relationship between culture and biology in the human past as this past increasingly anticipates the future.

Daniel Segal and Sylvia Yanagisako (2005), critically analyzing the intellectual integrity of the four-field approach in anthropology, have argued that the four subfields are far more dissimilar than similar with regard to methods, theory, and analysis and that claims of integrated holism belie a disciplinary history of ambivalent accommodation. Along these lines, they pose a semirhetorical question to cultural-social anthropologists who want to hold onto the holism of the four-field model: "When was the last time that research on hominid evolution or primates was helpful to you in thinking about your ethnographic data?" (2005, 11). Clearly, the answer to this question is meant to be a resounding "never." However, this answer has everything to do with the assumption that the ethnographic subject—humans—is a completely discrete category. My argument in this essay is that as we anticipate changes in biotechnology that blur the category "human" we enter a domain where, ironically, something resembling a holistic, four-field approach may take on new relevance. It is with reference to this that an engagement with the literature on the cultural dynamics of a specific kind of biotechnology makes research on hominid evolution relevant to a kind of ethnography that crosses species barriers. Conversely, thinking about an ethnography of this kind provides a critical point of reference for a reconsideration of the dynamic of species interaction in hominid evolution.

Although in general terms Segal and Yanagisako are right, there are, increasingly, critical points of topical overlap and analytical intersection between the various subfields as cultural anthropologists study the consequences of innovations in biology and physical anthropologists engage in new ways with questions about the evolution of culture (Quiatt and Itani 1994), nonhuman primate cultural dynamics (de Waal 2001; Goodall 1986; McGrew 1992; McGrew, Marchant, and Nishida 1997), and what it means to be both a sentient person and an animal (Corbey 2005; Lenclud 2000; Marks 2003; Stanford 2001). It is on this latter point in particular that metaphysics, genetics, and the construction of cultural meaning intersect most directly. Nevertheless, as Corbey has recently pointed out, humans are very ambivalent about their status as apes, and a historical analysis of the study of nonhuman primates clearly shows that the dichotomy of nature-as-different-from-culture is central to our understanding of humans as similar to but different from the other great apes.

Significant changes in the discipline of biology—which is now much more proactive, technology-driven, and focused on engineering than simply concerned with understanding the nature of nature as such (see Franklin 2001, 303)—are making it possible to rethink the binary distinctions between nature and culture that are at the root of both our "ape-angst" and anthropology's subdisciplinary fracture. By engaging with the literature on biotechnology, species categorization, and hominid evolution, this article is a self-conscious attempt at a different kind of "old anthropology" and an argument for thinking about nature and culture in terms of a new critical synthesis.

As a number of scholars have pointed out, technologies such as genetic engineering, genetic testing, in-vitro fertilization, and cloning provide dramatic examples of the infusion of biology with powerful cultural meaning (Brodwin 2000; Franklin and Ragoné 1998; Franklin and Lock 2003). New assisted-reproductive technologies have dramatically changed the way in which kinship relations are understood (Franklin

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1997, 2001; Strathern 1992), genetic testing has transformed the way in which health and illness are conceptualized and embodied (Rapp 1999), and the Human Genome Diversity Project has raised serious questions about identity, autonomy, and relatedness (Marks 2001).

As Franklin has recently demonstrated, cloning and stem-cell modification are forcing revisions in a whole spectrum of modes of classification, producing what she refers to as "recombinant" categories (2003*a*; see also 2003*b*, 97–127). As she points out, animals play a vital role in the development and commercialization of biotechnology and are directly implicated in the transformation of nature. The cloned sheep Dolly is simply the best example of what she calls the "new wild"—"both a domesticated or even ultradomesticated livestock animal and at the same time a biological unknown, with an unpredictable genome" (2003*b*, 102). Biotechnology is also producing recombinant organisms that blur the categorical distinction between human and nonhuman animals and force the question of human uniqueness. Along these lines, the bioethicist A. M. Chakrabarty poses the following provocative questions: "Is a chimpanzee-like baby produced from a chimpanzee donor nucleus to a human egg and borne by a woman a human or a chimpanzee? Alternatively, is a human-like baby produced by a chimpanzee mother whose chimpanzee egg has been fertilized via the transfer of a human nucleus a human or a chimpanzee?" (2003, 21). These questions cannot be answered, but they reflect one of the central concerns in contemporary anthropological theory: the blurring of boundaries between nature and culture, or what might be called the natural nature of artificiality in the world as we know it (Franklin 2003*a*). Paul Rabinow (1996, 99) articulates the most general implications of this development:

> In the future, the new genetics will cease to be a biological metaphor for modern society and will become instead a circulation network of identity terms and restriction loci, around which and through which a truly new type of autoproduction will emerge, which I call "biosociality." If sociobiology is culture constructed on the basis of a metaphor of nature, then in biosociality nature will be modeled on culture understood as practice.

In essence, then, this essay is a meditation on the reification of culture and the cultural construction of nature as at once real and artificial. It is about the biosocial identity and restriction loci that are at play in the autoproduction of a human/nonhuman hybrid animal and the way in which the particular forms of cultural practice that are implicated in this endeavor have shaped humans in the past and may reshape our relationship to other animals in the future. Beyond showing how a breach in our species's species barrier makes it possible and perhaps necessary to forge a new kind of holistic anthropology, the specific goal of this essay is to extend insights on the relationship between biotechnology, kinship, and relatedness and reflect on the nature of cross-species "kinship" and a kind of "new/old wild" that is made possible by technologically blurred species boundaries.

Degrees of Difference: What Is a Species?

With the development of new technologies in the field of bioengineering, what was thought to be a relatively clear biological line between human and nonhuman animals is becoming far less clear (Haraway 1997). Inserting embryonic stem cells from one species into the embryo of another to produce a hybrid organism is increasingly becoming a very real possibility. The implications of this germline manipulation are much more profound than the production of transgenic animals that contain specific human genes—or transgenic humans that contain nonhuman animal organs—in that it involves the whole genomic sequence.

Clearly, very serious ethical issues are involved in determining what kind of hybrid organisms can and should be produced, with what safeguards, by whom, and for what purpose (see Annas, Andrews, and Isasi 2002). These issues have been taken up most recently by the British government in making revisions to the UK Human Fertilisation and Embryology Act (Editorial 2007). The government's proposed ban on the production of chimeric embryos is ostensibly a response to "considerable public unease," although the unease seems to be based on a misunderstanding of the kinds of chimeras that can be produced and what purpose they will serve (Enserink 2007). As Robert and Baylis (2003, 2) point out, underlying the ethical question is a problem of species-specific classification:

> At present the prevailing view appears to be that species identity is fixed and that species boundaries are inappropriate objects of human transgression. The idea of fixed species identities and boundaries is an odd one, though, inasmuch as the creation of plant-to-plant and animal-to-animal hybrids, either artificially or in nature, does not foster such a vehement response as the prospective creation of interspecies combinations involving human beings. . .. This suggests that the only species whose identity is generally deemed genuinely "fixed" is the human species. But, what is a species such that protecting its identity should be perceived by some to be a scientific, political, or moral imperative?

In other words, more than is the case with other scientific terms "species" is defined in terms of social, political, and moral priorities. Quite apart from what can be made to happen in laboratories—where such things as ligers (lion/tiger hybrids) and geep (goat/sheep hybrids) are produced—there are many examples of plant and animal species' crossbreeding in the wild. The significance of this is in terms of evolution is one thing (see Arnold 1997); what it signifies with regard to ethics and the apparently "fixed" boundary between species is quite another.

While most research in biotechnology is oriented toward practical biomedical issues—the manufacture of "rejection-

proof" human-like organs in pigs, for example—what captures the imagination and causes ethical, moral, and legal contortions is the real possibility of taking an organism that is genetically 98% human and manipulating its cellular structure so as to make it into a creature with recognizable human characteristics (see Chakrabarty 2003; Glenn 2003; Marshall 1999; Resnik 2003). What is interesting about this is that it is a kind of return to various points in our species's evolutionary past (see Patterson et al. 2006) by means of technology that is, in essence, both postmodern and futuristic. Ethical problems aside, it affords us an opportunity to think about what it means to be a human animal both with an appreciation for evolution and with skepticism about some of the assumptions that are built into evolutionary theory and our cultural understanding of human evolution.

In many ways the concept of a species is fundamental to modern biology, given that it is integral to theories of evolution. Philosophers of science point out, however, that what we mean by species in general or a specific species in particular is ambiguous. As Robert and Baylis (2003, 3) make clear with reference to the work of Wilson (1999), Ereshefsky (1992, 1998), and others, there is "no authoritative definition of species. Biologists typically make do with a plurality of species concepts, invoking one or the other depending on the particular explanatory or investigative context." On the most general level, the problem with the notion of species is that it is atemporal and based on biological similarity and standardized population identity, whereas reproduction is an inherently temporal—or temporally significant—individualized act. Evolution operates through time on the level of populations in terms of variability on an individual level. Although ultimately they hold that species are objectively real, Sterelny and Griffiths (1999, 180) point out that

> one view of evolutionary history suggests that species cannot be real. If a smooth continuum of change links us to the earlier primates from which we evolved, then there can be no fundamental difference between (say) *Homo sapiens* and *Homo erectus*. . . . The idea, then, is that if phenotypic change does not proceed by large jumps (*saltations*), then species are not objectively identifiable over time.

Of the many species definitions in play, three seem to be in most common usage: (1) the biological species concept, modified as the cohesion species concept, (2) the ecological species concept, and (3) the phylogenetic species concept, based on cladistic logic. Formulated by Mayr in 1942, the biological species concept—for which mate recognition and reproductive isolation are definitive—has structured the field and defines the nature of the debate. While obviously useful for zoologists working in the present, for paleontologists the definition is not so much wrong as simply useless: the criteria for judgment are not in the data. Even for biologists, however, the concept is problematic in focusing exclusively on gene flow; hence Templeton's (1989) formulation of a species concept that recognizes the fact of ultimate reproductive isolation but defines a species in terms of the role it plays in an ecosystem. Templeton's cohesion concept modifies a strict ecological definition of species: "a group of organisms whose members share an adaptive niche and can replace one another's descendents if they find more efficient ways to occupy that niche" (Sterelny and Griffiths 1999, 193).

From the perspective of paleontology, the phylogenetic species concept is most directly operational. Following the logic of cladistic reasoning and a parsimonious delineation of derived and inherited traits—interpreted as such on the basis of the fossil record—species are defined as organisms that are grouped together as lineages by virtue of falling in between hypothesized speciation events (Sterelny and Griffiths 1999, 192). From a strict cladistic perspective, however, a biological definition of species is irrelevant to the question of lineage identity through evolutionary time. Moreover, the supposition that species fall into ever larger taxonomic categories is highly problematic, since distinctions between genus, family, and order entail judgments about degrees of evolutionary divergence rather than measurements of objective divergence in fact (see Corbey 2005, 145–48). On this Sterelny and Griffiths (1999, 201) write:

> Cladists do not think there is a well defined objective notion of the amount of evolutionary divergence. That is, in part, why they are cladists. Hence they do not think there will be any robust answer to the questions, when should we call a monophyletic group of species a genus? a family? an order? Only monophyletic groups should be called anything, for only they are well-defined chunks of the tree. But only silence greets the question, are chimps plus humans a genus?

In large part what matters is one's point of temporal reference and what gets counted as standard or typical. "If the human lineage continues to change, some future hominids, seeing themselves as typical, might see us as the intermediate gradation between two other hominid species, *Homo future sapiens* and *Homo post erectus*" (Sterelny and Griffiths 1999, 180). From the perspective of the future we—including *Homo sapiens* from 180,000 years ago to some undetermined point in future time—might not be a genus at all. Genus delineations warp through time, as do species definitions—at least to the extent that they are, in fact, just lineages between marks that putatively establish speciation events.

Systematics based on cladistic logic and the construction of phylogenetic trees is clearly one of the best methods for understanding evolution, since it is based on tangible evidence. However, it may not be the best way to assess the relationship between various closely related hominid species in the past. Intragenus species taxonomy in the past is highly problematic. The original work that is directly relevant here is that of Jolly (1993, 2001), who developed an analysis of species and species hybridization among archaic hominin populations based on the model of the papionin monkeys. More recently, Holliday (2003) has sought to extend and generalize Jolly's argument. Drawing on Templeton's 1989 work on syngameons in mam-

malian taxa, in which the cohesion species concept is developed and applied, Holliday points out that there was most likely interspecific reticulate hybridization within the genus *Australopithecus* (2003, 660) as there is now within the genus *Papio* (see Jolly 1993). In the genus *Homo* it is even more likely: "A strict papionin analogy would, therefore, argue that all *Homo* (*sensu stricto*) were interfertile" (Holliday 2003, 559; see also Jolly 2001).

Recent developments in the comparison of the human genome with those of the other great apes seem to corroborate Holliday's analysis. Using variability across the genome to measure the time and process of genetic divergence between two species, Patterson et al. (2006, 1106) draw two significant conclusions: (1) that human-chimpanzee speciation occurred more recently than the fossil record would indicate, probably much less than 6.3 million years ago, and (2) that, given that an analysis of variation along the X chromosome indicates a relatively very recent genetic divergence time, there was probably gene flow between ancestral chimpanzee and ancestral human populations after they diverged:

> If human and chimpanzee ancestors initially speciated and then interbred, hybrid males might have been infertile, consistent with Haldane's rule. A viable population could then only have arisen if the fertile females mated back to one of the ancestral populations (for example, chimpanzee ancestors), producing fertile male hybrids when they transmitted X chromosomes derived almost entirely from the ancestral population. This could explain why humans and chimpanzees are most closely related throughout chromosome X.

Patterson et al.'s analysis has attracted significant media attention and generated debate between advocates of allopatric and of sympatric models of speciation. Barton (2006) and Innan and Watanabe (2006), for example, make counterarguments for the genome data using the null model of allopatric speciation. Patterson et al. have, essentially, provided a clearer perspective on sympatry as a multidirectional process involving mate choice across a porous species boundary.

Whether this qualifies as bestiality is an open question, but the recognition of syngameon relationships provides a perspective on kinship that is inclusive rather than exclusive. It helps us to translate the obvious—that we were once just animals—into the less obvious—that our kinship to animals is closer and more intimate than we have thought, both in fact (with reference to the evolutionary record) and in principle. Species are not fixed entities but temporal lineages with significantly fluid boundaries. To adapt Sterelny and Griffiths's provocative question, only silence greets the question whether chimps plus humans are a genus. At the end of the Pliocene in eastern Africa this may have made for strange bedfellows.

Human Evolution and the History of the Genus *Homo*

For the better part of 2.5 million years there have been very long periods in which more than one now-extinct species of human lived near one another (see Tattersall 1998, 1999). Of course, to accept the statement in this form it is necessary to assign the designation "human" on the taxonomic level of the genus rather then on the level of the species. The rationale for doing this is linked directly to culture in the form of cognitive consciousness: the ability to make a tool, however simple, out of a stone. It also has to do with bipedalism, which is closely linked to tool use. Bipedalism is clearly a biological adaptation, but tool use and production, while dependent on biology, are clearly cultural or at least protocultural even in their simplest forms. The earliest stone tools—which are relatively simple but still quite complex to produce—predate the genus *Homo*. As Tattersall (2002, 98–99) puts it in a popular account of the pros and cons of reclassifying early *Homo* specimens to the genus *Australopithecus*:

> Nothing changes the fact that there are no really good associations between any fossil hominids and early stone tools. . . . Thus we have to conclude, at least for the time being, that stone tool technology was the *intellectual* [my emphasis] offspring of hominids with archaic body proportions, and who probably also possessed small brains. We should not be surprised by this. . . . After all . . . any innovation, whether physical or technological, has to arise initially *within* a preexisting species—for where else can it do so?

There are at least two important points to be taken from this. First, in evolutionary time culture not only has crossed the species barrier but would have had to. Second, the invention of technology based on intellect separates history from evolution. History does not, obviously, supplant evolution, but it does establish a developmental pattern that is disconnected from the patterns of speciation to which Tattersall primarily refers. Another way of saying this is that in the context of evolution, history is what happens between speciation events, although it can continue under the banner of a new species. Around 2.5 million years ago the emergence of a kind of history that contained the dynamic for a new kind of change—learning-based intellectual innovation—had a profound impact on the evolutionary development of a number of different species in three different genuses: *Australopithecus*, *Paranthropus*, and *Homo*. In the historical time of these evolutionary lineages, genes and culture crossed a significant number and variety of species barriers—and the historical time of early *Homo* can be counted as our time if the criterion is genus-specific culture.

Although the logic used here is based on a phylogenetic species concept, the picture that emerges is closer to Templeton's cohesion species concept, in which a species is defined as "the most inclusive group of organisms having the potential for genetic and/or demographic exchangeability" (Templeton 1989, 25). If the defining feature of a species is its performing a distinctive role within an ecosystem and if culture in the form of stone tools comes to play an increasingly important role in shaping that ecosystem, then this further blurs already

fuzzy species barriers, both in historical time and in an evolutionary framework.

Consider here the literature on whether *H. neanderthalensis* and *H. sapiens* mated and produced viable offspring: One view, articulated by Tattersall and Schwartz (2001), among others (Rak, Ginzburg, and Geffen 2002), is that they did not, or at least that there is no evidence in the fossil record for individuals with clearly discernible combined traits (Tattersall and Schwartz 1999; Tattersall 2002, 132). Others argue that there was probably significant intermingling, as there is in other closely related species. Holliday points out, following Jolly, that it is quite likely that *H. neanderthalensis* and *H. sapiens* constituted a syngameon (2003, 659). Although analysis of the emerging data on the Neanderthal genome (Green et al. 2006, 335) suggests only minimal if any Neanderthal genetic contribution to the modern human genome, a discontinuity between the high level of derived alleles in the Neanderthal sample and the timing of the "simple population split model . . . may suggest gene flow between modern Humans and Neanderthals. Given that the Neanderthal X chromosome shows a higher level of divergence than the autosomes (R.E.G., unpublished observation), gene flow may have occurred predominantly from modern Human males into Neanderthals." This scenario mirrors the findings of Patterson et al. (2006) for mate selection and gene flow between archaic humans and archaic chimpanzees. Moreover, as Patterson et al. point out with reference to the work of Barton (2001), "hybridization could be advantageous, allowing nascent species to derive traits from several ancestral populations, combining them to adapt to new environments" (2006, 1106). While the mtDNA evidence seems to show that there are no Neanderthal genes in the modern human gene pool (see Green et al. 2006), on the basis of the principle of hybrid reticulation it is possible that some human traits derive from Neanderthal adaptations—large brains (Evans et al. 2006) or pale pigmentation of the skin, perhaps. (Green et al. [2006, 336] predict that the Neanderthal genome will be decoded by 2008, at which point we will have more data on skin color, hair color, and the ability to articulate sounds, among many other things.) In a Barthean (1972) sense of sarcasm's being what counts as truth, this would be the ultimate historical retaliation in kind for racism's evolutionary ontology and its various biological entailments.

In considering the intimacy of contact and kinship between us as modern *Homo sapiens* and other species of animal within the genus, culture is not the only thing that can be said to make us unique. As in the case of most primates, the lice that our species hosts—*Pediculus humanus* and *Phthirus pubis*—are not found on other species, and parasites in general are very specific to a species. As evidenced by *Phthirus pubis*, they can even be restricted, allopatrically, to a rather isolated niche on the host in question. While the fact that the divergence date from a common ancestor of the two species of louse found respectively in human head hair and chimpanzee fur is more recent (5.6 million years ago) than the divergence date between the human pubic louse and the common ancestor of all three (11.5 million years ago) raises interesting questions, variability in two lineages of *P. humanus*—what in another time and place, with reference to a different genus, would have been mistakenly called races—provides key insight into some form of relatively intimate contact between *H. erectus* and modern *H. sapiens* as the latter came out of Africa and encountered the former. As Reed et al. (2004, 1979) point out, the nature of the contact had to be direct and physical, since lice cannot survive for long when removed from their host, but only a comparative analysis of pubic-louse lineages would provide direct evidence of interspecific intercourse.

Is it possible to talk about coeval species with culture, covering the range of anatomical variation manifest in the fossil record, as extinct humans while reserving the concept of human nature or humanity—and, of course, inhumanity—for *H. sapiens*? On the surface it makes sense to do so, since most paleoanthropologists agree that with the refinement of the prepared-core technique, the invention of tools of materials other than stone, and the ability to think and communicate symbolically humans became the fittest species in the genus *Homo*. However, this happened at a time—our own historical time—when the other species of *Homo* around were, very clearly, engaged in activities that overlapped and that involved the use of culture to a considerable degree (see, e.g., Bietti 2002; Clark 2002). To what degree is difficult to say (d'Errico 2003), and the picture of chronological sequencing and niche coresidence is complicated by new radiometric dating techniques that challenge the old model of evolutionary transition in the Levant (Shea 2003). If Swisher et al.'s (1996) dating of the *H. erectus* remains from Java to 40,000 years ago is accurate, then we are dealing with an even greater degree of coeval "human" species differentiation.

Research into the origins and evolution of language and the ability to produce gestures (Corballis 2002) and sounds that could be organized into patterns of speech is directly relevant here (see Habib, Joanette, and Lecours 2000). Language has often been used as a boundary marker of *H. sapiens* as a distinct species, with the uniqueness of language and linguistic ability being marked in terms of the relationship among cognition, morphology, and a range of "genetic" traits that are unique (Eisenberg 1972). However, there is no basis for assuming that the universality of language is based on genetics either within or beyond a putative boundary (Hull 1986). Theoretically this leads directly to the research on the development of language in the evolution of the species within the genus *Homo* (Bickerton 1990, 1995; Knight, Studdert-Kennedy, and Hurford 2000; Jablonski and Aiello 1998) and on the ability or inability of Neanderthals to speak (Boe et al. 2002; Heim, Boe, and Abry 2002). Most of this research has been concerned with speech and the relative and absolute size of the hypoglossal canal (Milo and Quiatt 1993; see DeGusta, Gilbert, and Turner 1999 on the fallacy of the hypoglossal-canal hypothesis).

Corballis (2002) argues that speech is a derivative cultural invention based on an earlier form of gestural language. Whereas gestural language probably developed as an evolutionary adaptation based on the intersection of change along several axes—environment, physiology, and social interaction, both cooperative and competitive—and can be conceptualized as a medium of communication that triggered various incipient cognitive abilities and brought culture into being, speech can be understood as a metacultural construction. In other words, a gestural theory of the origins of language significantly complicates the notion that language is what makes modern humans unique as a species.

From the vantage point of paleoanthropology, none of this is particularly problematic, since the category "human," to say nothing of what counts as humanity or human rights, is irrelevant with regard to evolution—humans are simply *H. sapiens*, an animal that has come to possess such a powerful adaptive mechanism that it has expanded its ecological niche to the absolute limit of known organic life. In our ability to transform nature we both make and adapt to our niche in much more dramatic ways than other animals (Odling-Smee, Laland, and Feldman 2003). The ineluctable fact of adaptation through natural selection is what made us human in the first place. It is also what defines us as an animal, if not also—and more simply—an organic form of life. But aside from the conceit that comes from being the only species-representative of a genus that over time shared the power of culture with upward of ten other species and two other genera, a key question is how—exactly, and with what range of inclusiveness—culture counts as the defining basis of "our" humanity and who or what is included within the possessive form of that pronoun.

Our Chimeric, Cyborg Nature: History from 180,000 Years Ago to the Future

There is a certain logical symmetry and perhaps ethical accountability—defined with reference to the historical past of our species, rather than just the present—in breaking down, with the postmodern technology of embryonic stem-cell hybridization, a cultural barrier erected by the prehistoric invention of tool use 2.5 million years ago. This is a barrier that has been reinforced countless times with tools of ever-greater sophistication, including that tool of tools, the human body. Language, as we now use it, is produced through the cognitive manipulation of body parts (tongue, throat, teeth, lips) that were not designed for speech—for vocalization, among other things, yes, but not for speech. But then fingers, hands, and other body parts (eyebrows, for example) were not designed for gesture. With culture we self-consciously manipulate the world around us, including our own biology. With the advent of culture we did not stop being animals. But neither did we ever just become human. We made ourselves into humans—which raises the question how far that process can and should be taken.

When *H. sapiens* became human they also became cyborgs, since the reflexivity of culture bends biology to such an extent that biology itself becomes an artifact of culture (Haraway 1991, 150): "By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centers structuring any possibility of historical transformation." Donna Haraway focuses on the modern history and postmodern condition of cyborgs. My concern is with the prehistoric logic of our chimeric, cyborg nature, which has a direct bearing on the questions Chakrabarty has posed.

To imagine the possibility of a team of geneticists' mixing and matching the embryonic stem cells of chimpanzees or gorillas and humans to produce a viable, hybrid fetus that combines the best features of each—brain and brawn, for example—is to imagine science fiction. Among other things, one must imagine one kind of being's being born to another, a situation in which biological kinship would cross the species barrier. As Marilyn Strathern has wryly noted, "relatives are always a surprise" (2005, 15–32), and biotechnology extends the scope of kinship along with all of its social entailments. As Robert and Baylis (2003, 8) provocatively put it with regard to the production of pluripotent human stem cells in mice embryos and the production of a chimeric mouse/human, "What if the chimeric mouse has human sperm cells? And what if the mouse were to mate with a chimeric mouse with human eggs?" This sounds like fiction. Perhaps it would even qualify as post-Gothic science fiction if it were not for the fact that the National Academy of Sciences—an institution very much concerned with facts and reality—has established ethical guidelines stipulating that researchers who produce chimeras with mixed-species germlines not allow their creations to mate. Given both the facticity and the fictional qualities of cutting-edge genetic research, it is not at all surprising that in his most recent novel *Next* (2007) Michael Crichton blurs fact and fiction to engage with the question of chimeras and the fear, fascination, and discomfort they produce.

However new this specific problem may be, the issue itself is a biosocial one that has been a long time in the making. Focusing explicitly on the biosocial matrix of hybridity, Haraway has argued that "the boundary between human and animal is thoroughly breached" and the distinction between organism and machine is, at the very least, highly porous (1991, 151–52; see also Klugman 2001; Kull 2002). Building on Haraway's work, Williams (1997) examines a wide variety of medical technologies that are implicated in the production and conceptualization of human embodiment in terms of cyborg hybridity. In some sense a cloned organism is an organic tool, a living, breathing machine. A mouse that is alive but has a unique and useful genetic makeup given to it by its maker/owner is as much a machine as it is an animal.

It is with this in mind that Haraway refers to the relation-

ship between science fiction and social reality as an "optical illusion." As she puts it, a cyborg (human/animal/machine) is "a creature of social reality as well as a creature of fiction. Social reality is lived social relations, our most important political construction, a world-changing fiction" (1991, 149). Chakrabarty's questions intimate the world-changing fiction of embryonic stem-cell hybridization. Those who are opposed to this kind of genetic engineering seek to reinstate the clear-cut duality of nature and culture so as to preserve the order of things. Their concern is to prevent fictional reality from getting confused with what is really real and natural. Whether or not one agrees with this position, there is no question but that it prevents one from exploring the political and moral possibility of a more radical, nondualistic, Möbius perspective on the future as this future invokes both the historical and the evolutionary past of our species.

The point at which the human terms of sociality come most clearly into focus—but still very ambiguously—is in the well-known examples of nonhuman animals' being taught sign language. Although there is great debate on what this means, it seems increasingly clear that once gorillas and chimpanzees have been taught to sign by humans, there is a degree of improvisation that is independent of subsequent human intervention (see Savage-Rumbaugh 1998). Language ability, however rudimentary, takes on a life of its own, and even as a so-called protolanguage it can become a means for communicating across the species barrier. In a sense, research intent on proving Chomsky wrong about the exclusive link between humans and language anticipates a biological breach in the species barrier. In the context of a more extended discussion of why we should not think of language as a uniquely human trait, Craig Stanford (2001, 161) has forcefully pointed out that as a species we have not fully come to terms with the moral and ethical responsibility we have for having taught great apes our language:

> The small group of great apes that have become language-savvy are in a bizarre category. They are chimeras, not human but endowed with a human quality that their kind would not possess without years of human training. They are, in a sense, more sentient than their species is supposed to be. . . . Some of the chimps reared to be language users have ended up in the dungeons of biomedical laboratories. . . . Like some sort of ape-human hybrid, they are trapped in the netherworld between two species.

The implicit logic here is the same as that made explicit by Marilyn Strathern (2005) with reference to species-specific human kinship, albeit in terms of training rather than technology: language ability produces new kinds of relationships with clear moral, ethical, and legal entailments, although these are not categorically different from the entailments reflected in "natural" kinship or in our ability to understand how chimps communicate with one another or how they understand what we are trying to say.

In any case, the social consequences of language's being mixed into the process of genetic hybridization will be far more revolutionary than the biological consequences alone.

Conclusion: Freeing Nature in Freeing Ourselves

As Rabinow, Haraway, and others have shown, articulations of science are embedded in specific historical and cultural contexts and both define and are linked to different discursive fields. In this regard four-field holistic anthropology is what has given birth to the idea of chimp-human chimera, although clearly there are other, extradisciplinary factors involved. In the most general terms, the goal of this essay has been to apply this fact to a key question that is at the heart of anthropological holism: what makes us human? In the end the answer is the entailments of culture that ensue from kinship both within a species—which goes without saying—and across and in between species boundaries. Ironically, although four-field anthropology may well have been forged in ambivalence and characterized by a history of fracture and fragmentation (Segal and Yanagisako 2005, 1–23), a mutated form of it may become more relevant as new kinds of "ethnographic subjects" take shape.

Jonathan Marks (2003) has made a strong and convincing case that the recent discovery of the close genetic similarity between chimps and humans does not really tell us very much that is new about the *relationship* between them. In referring to one possible configuration of this relationship—whether it is possible to create a chimp-human hybrid—he points out that the most difficult aspect of the question is not biochemical but ethical. How, by whom, and in what environment would such a creature be raised? What would it be taught? Who would be qualified to answer the question it might ask: Who am I? Somewhat ironically, therefore, a problem that seems to be concerned with the nature of nature is most complicated with reference to the dynamics of culture in general and kinship in particular. This is a point that is forcefully made in much of the anthropological literature on biotechnology, and it is on the basis of this that anthropologists have made significant contributions on key ethical questions concerning genetic testing, assisted-reproductive technologies, and cloning, among other things.

An equally important ethical problem is also grounded in cultural dynamics but is fundamentally socio-ecological rather than technological—viewing the relationship between us and other animals as interdependent. Haraway (2004) refers to the principle of companion species, a concept which resonates very well with Templeton's theory of cohesion species. Haraway's example of coevolutionary companion species is iconic: *H. sapiens* and *Canis familiaris*. In looking at this relationship, what very quickly becomes apparent is that human agency based on intelligence does not have pride of place. It is not as though humans were suddenly smart enough to recognize the practical utility of domesticating archaic wolves. Evidence from mtDNA analysis (Vila et al. 1997) indicates

that populations of archaic wolves and archaic humans probably adapted to one another long before the practice of domestication as such and probably as early as the earliest fossil evidence of *H. sapiens* (Haraway 2004, 303). In part building on and expanding Haraway's analysis as well as Peter Singer's philosophy of animal rights, Agustin Fuentes (2006) has developed an argument for "shared personhood" across a range of animal species including humans. Primarily concerned with the question of human cruelty toward nonhuman animals, Fuentes develops a notion of shared personhood not in terms of culture but in terms of "similar physiologies and shared sensory modalities" (p. 126). As he points out, "*Personhood* . . . is recognition of a shared interpretation of a response to interactions with environmental and social stimuli caused by common physiological and related biological systems."

In any case, cross-species behavioral biology within an ecosystem increasingly defined by the work of cultural practice and/or common sensory responses to stimuli is simply one issue. In the context of cross-species hybridization the principle of companion species—if not coevolutionary development—is radicalized to the point at which in theory it ought to become impossible to think about ethics, rights, legislation, or just about anything else in exclusively human terms. The questions raised will take us—however inclusive that category becomes—well beyond eco-politics and animal-rights paternalism. As Haraway puts it with reference to the work of Engels (1940) and Kropotkin (1902) as concerns the place of nature in the social relations of liberation, "We need to know the animal science of the body politic as it has been and might be. I believe the result of a liberating science of animal groups would better express who the animals are as well; we might free nature in freeing ourselves" (1991, 12).

Fundamentally it is the social relations between animals—humans, nonhumans, and others betwixt and between—that ensue from a breach of the species barrier that will produce a situation in which the issue of animal rights will take on profound significance. Humans interact with nonhuman animals, machines, and both human and nonhuman animal-machines in any number of ways, but the social implications of this are defined in and on human terms. However wrong it may be to make a humanzee, making one will have the effect of redefining us as animals with a direct kinship to other animals. Twisting the dark legacy of unilineal cultural evolution and the classification of some "races" as animals (see Corballis 2005, 43–59), one hybrid species may become the ethnographic subject of another. In terms of degrees of difference the devil will most certainly be in the details.

The point is that when a semihuman hybrid is created, the species barrier will have been breached in a way that will entail social relations among a range of animals that are, to various degrees, like and unlike one another but not categorically different one from another. On the restricted level of a single genus this already happened—so to speak—millions of years ago, and we have a biosocial science that has made that event and its evolutionary and historical consequences the object of study. But, as I have tried to show here, intellectual reflection on what the future might hold can produce a critical reassessment of putatively bounded categories in our evolutionary past, and projecting a history of the future onto our evolutionary past can bring the various subdisciplines into a single conversation on the scope, scale, and intellectual integrity of a discipline concerned with the biocultural nature of "humanimalkind."

Comments

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Alter argues for the continuing relevance of the "four-field approach" in anthropology. He identifies recent developments in biotechnology and, specifically, "technologically blurred species boundaries" as the subject of a new kind of holistic anthropology. Neither of us was trained in a four-field tradition, but we have some relevant experience in collaborating with other subfields. In 2004 we organized a Wenner-Gren international symposium that resulted in our edited collection *Where the Wild Things Are Now: Domestication Reconsidered* (2007). One of our primary goals was to encourage communication among scholars working in very different traditions, particularly biological anthropology, social/cultural anthropology, and archaeology. We found this project both challenging and productive. Our reasons for advocating collaboration among subdisciplines, however, are somewhat different from Alter's.

We agree with Segal and Yanagisako that there is a great deal that separates different branches of anthropology and anthropologists should not be bound to any particular orthodoxy regarding how they should be related. We also agree with Alter that there are some good reasons for continued dialogue and collaboration across natural science/social science/humanities boundaries and that, especially now that there has been so much critique of a nature-culture binary, there are many new opportunities for inter-subfield collaboration. Where we differ from him is in believing that some of the most important reasons to keep different branches of inquiry in dialogue with one another are rather traditional and ordinary. While we find Alter's discussion of the possibility of a "humanzee" quite interesting, we suspect that developments in biotechnology are not the only and perhaps not even the most convincing argument for the continued relevance of a four-field approach. Ways of thinking about race, evolution, the body, medicine, domestication and the "wild," humans' relationships with their environments, kinship—these are just a few examples of more mundane points

of connection and sites of productive collaboration among radically different fields of inquiry.

Alter argues that "new assisted reproductive technologies" have "changed the way in which kinship relations are understood." This requires clarification. It is clear from the ethnographic work cited by Alter that particular reproductive technologies generate their own social worlds and inflect or otherwise make use of existing (culturally variable) ideas about relatedness to greater or lesser degrees and differently in different contexts. In the case of the undifferentiated category of "biotechnology" this concern is even more pressing. The example explored in most detail, the species distinction, is not a problem of biotechnology. It is a perpetual problem of how to carve up the world that has been answered differently at different times and in different places.

Segal and Yanagisako's rhetorical question "When was the last time that research on hominid evolution or primates was helpful to you in thinking about your ethnographic data?" (2005, 11) is not helpful as a litmus test of the benefits of dialogue and collaboration, nor is it the basis of their argument against the four-field approach.

If you are a cultural/social anthropologist it is likely that the people you are trying to understand have ideas about the things that people in linguistics, biological anthropology, and archaeology have spent a good deal of time studying. That for us is a good reason to work with people in different branches of anthropology. Biotechnology is just one area where this connection is called for.

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To some extent, anthropology as the study of humankind is itself an articulation of the Euro-American worldview and is still struggling to rid itself of Eurocentric conceptions of "unique" humanness, "natural" order, and the animal-human boundary. Alter claims that transgressing our species boundary by making a human-chimpanzee hybrid might help—that the very idea can effect a redefinition of ourselves as animals with a direct kinship to other animals, reestablishing intellectual and disciplinary coherence in anthropology by facilitating communication between its subfields.

Alter hopes that our species boundary will be broken down as a beneficial effect of biotechnology. In fact, however, similar boundary transgressions have occurred and have usually been rebutted. Linnaeus lodged humans in the same order and even genus as the newly discovered "apemen"—the great apes. This was sharply criticized and soon reversed. The even more intimate association of humans with not just apish kin but apish ancestry advocated by Darwin was neutralized in several ways, for example, by postulating a long ascent to civilization from the lowly apes and by excluding human reason and morality from the process.

The response to the discovery of "essentially human" behaviours—symbolic communications, tool making, politics, altruism, self-recognition in mirrors—in alloprimates in recent decades has been to change the criteria for humanness. Communication had to be not just symbolic but syntactical, for example, and one had to look not just for tools but for tools made with tools. Thus the ape-human boundary was upheld by redefinition. The message from the (disciplinary) past, therefore, is less than optimistic. Preconceived ideas about humanness—the last bastion of Aristotelian essentialism and *scala*-thinking in the era of Darwinism—have repeatedly thwarted empirical progress.

I have analysed this constant policing and renegotiating of the most strongly tabooed categorical boundary in the Western worldview in terms of pollution avoidance *sensu* Mary Douglas (Corbey 2005). In eighteenth-century Sweden, scores of young men who had had sexual contacts with farm animals were put on trial and executed for a similar, though less severe, transgression as that of Linnaeus. A humanzee (human-chimpanzee hybrid) by the same cultural logic would be a monster, produced by violating "natural order."

Therefore, while pragmatically admiring and endorsing Alter's optimism about blurring our species boundary, theoretically I am inclined to be more cautious—all the more so because, historically, two great, incompatible metaphysical traditions of the West feed into anthropology: one thinking top-down, stressing the unicity and dignity of the human mind and morality, and the other thinking bottom-up, stressing processes and continuity in nature. The former is evident in, for example, Boasian and Durkheimian ethnology and post-processual archaeology and the latter in various life-sciences approaches to humans' cultural behaviour and processual archaeology. The two tend to try to colonize one another's field. Nature becomes culture when studied by interpretive anthropologists in terms of perceived and symbolically categorized bodies, landscapes, kinship; cultural behaviour becomes a natural phenomenon in Darwinist approaches, talking of causes, events, and laws, much less of reasons, actions, and meanings. Hostility, red-lining, and ridicule ("postmodernists," "reductionists") abound in most anthropology departments worldwide.

This bifurcation, at play between and within the four fields, is what Alter is opposing, and justly so. But there are, of course, other impulses towards integration than just theorized hybrids. Generally speaking, anthropology as such, as the study of humankind, should not miss out either on cultural meaning and the moral, legal, and political issues that the first type of paradigm handles so well or on the immensely successful evolutionary approach which is the other paradigm's forte. More specifically, as Rena Lederman (2005, 50) puts it, "cultivating cross-subfield accents—identifying affinities and openings that make strategic cooperation possible among the subfields—has been, and may continue to be,

anthropology's distinctive disciplinary resource for addressing important . . . issues."

In fact, in recent decades we have seen life-sciences viewpoints being applied to cultural, linguistic, economical, and religious behaviours on an ever-increasing scale. This is laudable, for the reception of Darwin in cultural anthropology was long overdue and we can assess its limits only by continuing to carry it through. Some promising areas of strategic cooperation other than hybridization are reciprocity, altruism, ethno-aesthetics, ethnobiology, gene-culture coevolution, and cultural primatology.

There are no easy answers to the ongoing paradigm struggle in anthropology, but cultivating such cross-field accents is certainly one approach. Furthermore, the sort of epistemological reflection that Alter provides is all-important: looking not so much, *intentione recta*, at anthropological data as such but, *intentione obliqua*, at our ways of handling them in terms of our basic presuppositions and their historical roots. This might go some way towards effecting more charitable readings of paradigms other than one's own.

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Species have many correlated attributes, of which we take the most defining to be participation in a common stream of potential mates or competitors for mates. Since species evolve, they can be found in nature in various stages of formation. That is largely uncontroversial (Godfrey and Marks 1991). What is controversial is whether we need to help it along, by testing the limits of the human species with biotechnology or anything else. I find much to agree with in Alter's call for anthropology to have a close look at the human-animal boundary; it is certainly a locus of symbolic power (Ingold 1988).

What I wonder about is the role for us *biological* anthropologists in Alter's vision. Not only are we ostensibly intellectual mediators of the natural and the cultural (Goodman, Heath, and Lindee 2003) but we are also the custodians of our own "sacred bundle"—namely, the scientific narrative of who we are and where we come from. This sets up a conflict: We have to present our work as science, but it is obviously very mythic (Landau 1991; Cartmill 1993). The appropriate venue for reconciling these would seem to be a relativizing "anthropology of science" as an alternative to the naive positivism that still lingers in much of biological anthropology.

This tension between the semiotic and the scientific has created some noteworthy paradoxes. The science journalist Nicholas Wade, whose articles in the *New York Times* have consistently promoted race reification and biological determinism, recently published a book on human evolution (2006). Because of Wade's arguments that, for example, natural selection explains Jewish intelligence and Chinese pingpong, the review in *Nature* (Weiss and Buchanan 2006, 814) found it to be "in step with a long march of social Darwinists." So what does it mean, then, that the Leakey Foundation, a normative philanthropy for biological anthropology, chooses to sponsor public anthropology lectures this past April by a social Darwinist science journalist? It might mean that biological anthropology as science (i.e., the voice of authority) is actually losing touch with nature (i.e., whatever is "out there") and is doing so in highly instrumental ways. In some departments it is becoming hard to tell biological anthropology from evolutionary psychology. Even in something as basic as primate taxonomy, reality seems to be in full retreat, although the claim to be representing nature is not. Let me give a few examples:

1. Conservation issues have driven the number of primate species approximately to double in the past 20 years (compare Richard 1986 and Smuts et al. 1987 with Strier 2006 and Campbell et al. 2006). The currently recognized species of lemurs alone have little connection to any ostensible biological reality (Tattersall 2007). But most primatologists (myself included) are comfortable with this "taxonomic inflation," because worldly conservation issues outweigh abstract scientific ones.

2. All the major textbooks of physical anthropology are using a new classification privileging the *temporal* divergence of the orangutan (from human-chimp-gorilla) over the *adaptive* divergence of humans (from chimp-gorilla-orangutan). The two assumptions of this new classification are (*a*) that only clades—closest relatives—can be recognized in a classification, so Family Pongidae (chimpanzees, gorillas, and orangutans) cannot be used, and (*b*) that humans are genetically so similar to apes that their taxonomic distinction must be concomitantly reduced.

Many biologists are dissatisfied with the first assumption (Wilkinson 2002), as it would obliterate other groups—prosimians, australopithecines, whales, reptiles, fish, and prokaryotes—all of which have the same problem as Pongidae. The second assumption is so crudely reductive that the great "holistic" biologists roundly rejected it decades ago (Simpson 1963; Mayr 1981). Simply put, if humans are genetically so similar to apes yet ecologically so different, why should the genetic similarity be privileged over the ecological difference in a scientific classification? Another "holistic" biologist, Julian Huxley (1955), suggested (in the pages of the precursor of this journal) that humans, who rely for their survival on the products of their collective intellect to a much greater extent than any other organism and who live in such utterly different relationships with their environment as a consequence, should be set apart from all other forms of life as the Subkingdom Psychozoa. All right, that was a little extreme. The point is that descent and divergence are *both* components of evolution, and to erase the latter in a classification is to

misrepresent grossly the processes of evolution and the relationships among their taxonomic products (Marks 2005).

3. In concert with the taxonomic compression of the human lineage from above, a new wave of strategic "splitting" is sweeping through human paleontology. The result is that more fossil species are being squeezed into less taxonomic space, and the classification becomes simply a lengthy list of reified species. Most textbooks now include *Homo sapiens, H. floresiensis, H. neanderthalensis, H. heidelbergensis, H. erectus, H. rudolfensis, H. ergaster, H. habilis,* and, on a particularly bad day, *H. antecessor* and *H. helmei.* All but the first are now extinct. I guess technology was not such a great survival strategy, after all.

4. However different we construct Neandertals to be—and there is certainly evidence both of continuity and of discontinuity—the differences between them and us are still subtle enough that they need to be carefully pointed out to naïve audiences of students every semester. And again, this is not an abstract issue, for the taxonomic contrast of human and Neandertal lies just above the taxonomic contrast of the human races (Campbell 1962).

My question is: Who is going to explore this hybrid nature/culture space? It is not even clear that biological anthropologists are handling unhybridized "nature" particularly well. Or should social anthropology expand to fill this space? Certainly it has more of a knack for grappling with the cultural problematics of kinship.

On that I agree with Alter wholeheartedly: Kinship is ultimately what we are talking about here (and not the way primatologists use the term, either).

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Anthropology is technically a subfield of primatology rather than vice versa. This assertion, voiced in a gathering of cultural anthropologists, amounts to fighting words, and therein lies the current state of anthropology. However much I would like to disagree with Segal and Yanagisako's assertion (2005) that the four-field approach has become intellectually counterproductive, the reality is that the paradigm split in our field has grown to chasm proportions. Certainly there is vibrant research and rewarding collaboration at the biocultural boundaries of the discipline, but for the most part I think it is only grudgingly embraced by many of the newer generation of ethnographers.

Alter offers a new perspective. While equivocating a bit on whether humans are a discrete category from other primates (they both are and are not), he offers a new angle. He sees the future of the human species as, to use Haraway's term, a chimera of high technology and humanity accompanying the creation of a new and fundamentally changed *Homo sapiens.* Many scholars in the humanities and social sciences decry the ways in which technology changes us as a species. This argument has begun to seem quaint at best. Centuries from now the debate over stem cells, cloning, and genetic screening will seem equally quaint. Our twenty-second-century descendants are destined to be bionic in the same way that our twenty-first-century selves are the products of medical breakthroughs and technological advances our ancestors might have found morally suspect or downright evil.

Alter devotes a great deal of space to explaining species concepts in an effort to lay his groundwork for a new, emerging kind of human. His discussion of Patterson et al. (2006) shows insight and a thorough reading of the evolutionary biology literature. The common interpretation of Patterson et al.'s work on the apparently slow and halting divergence of the hominid-ape lineages is, however, a bit misleading. Alter gives the impression that hominids and apes split somewhat more than 6 million years ago and ape-human hybridization followed later. He cites this as evidence that naturally chimeric species are not a new occurrence. However, another reading of Patterson et al. is that the ape gene pool that gave rise to the hominid lineage did not do so in a clean break in a single locale. Speciation events occurred in multiple locations, with later contact between populations blurring the genetic distinctions for a further period of time. The stark ape-or-human dichotomy image does not accord well with the way in which speciation works.

Having set the human evolutionary stage with a further discussion of the emergence of genus *Homo*, Alter describes many of the conundrums paleoanthropologists face in deciding what to call "human." His statement "When *H. sapiens* became human they also became cyborgs, since the reflexivity of culture bends biology to such an extent that biology itself becomes an artifact of culture" is well put. Whether or not a cultural anthropologist accepts that natural and sexual selection influence the cultural choices modern people make, it is indisputable that cultural practices such as marriage and child rearing can affect reproductive success.

I fully agree with Alter that the blurring of the category "human" will be a topic for writers for centuries to come, continually raising provocative ethical issues. As for his argument that the emerging cyborg nature of humans provides new relevance for the four-field approach to anthropology, I cannot agree. The erosion of the four-field approach cannot be cast in terms of good or bad, nor can something split apart be sewn back together in a new guise. The paradigm split is what it is: the natural evolution of a highly interdisciplinary field that has grown at its boundaries only to find its center gone missing. We can bemoan the loss of tradition, interesting colleagues, and our sense of academic family, but such sentimentality has little sway in the progress of knowledge.

Reply

This essay is the second in a series of three in which I am concerned with problematizing the category "human" in order to try and rethink several theoretical issues and methodological questions. The first essay was "Yoga and Fetishism: Reflections on Marxist Social Theory" (2007), and in it I used a history of yoga philosophy and practice to extend and problematize Marx's notion of the social and social value in relation to the human animal and our "species being." The third, in progress, is concerned with a theorization of animal rights in terms of both hybridization and what might be called the "dialectics of parasitism." I mention these two essays because they frame my thinking here on questions of species differentiation, evolution, hybridization, and our chimeric condition as a species of animal with culture. Each of the three essays is concerned, in turn, with the sociology and politics of interspecific selfhood, interspecific biocultural kinship, and rights and moral obligations that are grounded in interspecific dependency.

The comments are welcome and very thoughtful interventions and provide solid intellectual purchase for what might otherwise have been a cultural anthropologist's leap of blind faith into the deep end of primate culture and biology. I agree with and take both comfort in and license from Stanford's opening remark that anthropology should, in fact, be considered a subdiscipline of primatology, provided that primatology, as a complex science of human self-reflection, embraces the mythos of science and is not governed by what Marks refers to as the lingering traces of naïve positivism in biological anthropology. In any case, apart from being written to make a point about the problematic of human uniqueness and difference—past, present, and future—this essay was also written as an experiment: to see if it would be possible to engage, in a single essay, on both empirical and theoretical levels, with some of the contemporary literature in all four fields. To adapt Stanford's metaphor, the exercise was to weave together the loose ends of knowledge on the boundaries of a discipline with no center. Those who are prone to parse will note that archaeology got short shrift and that an analysis of evolution and culture opened the disciplinary door to both cultural studies and biology. Regardless—and although I plead guilty to a certain nostalgia for broad intellectual coherence as well as institutional and administrative honesty about what makes sense in terms of departmental if not disciplinary coherence—my intention was not to wax sentimental about the demise of four-field holism but to use insights from a range of different subfields to reflect on the more general problem of any "field's" disciplinary integrity. This experiment was obviously conducted seriously and in earnest but from an analytical vantage point of skepticism about reaching definitive conclusions. I will return to this point later.

Two general concerns, very closely related, can be distilled from the comments. The first point—emphasized by all five commentators—is that, while "extreme," the case of human–nonhuman-animal hybridization is not the only and certainly not the most common case in which "nature" is problematized and there might, therefore, be productive subdisciplinary intellectual cross-fertilization. The second point—emphasized by Corbey and Stanford—is that, while intellectual collaboration such as that engaged in and advocated for by Cassidy and Mullin is good and very productive, there are such extreme paradigmatic and philosophical differences between the subfields of the discipline that it is useless to think—and presumably theorize—in terms of a single, overarching intellectual framework held together with agreed-upon facts, standardized methods, and accepted frameworks of analysis. On this issue Marks's point of entry is somewhat different, since he reads in my essay an opportunity to wrestle with an array of demons in the subdiscipline of biological anthropology. In doing so he raises the important point that there are profound political and ideologically charged disagreements on key issues within that subdiscipline. How do these disagreements play out in terms of inter-subdisciplinary intellectual cross-fertilization when there are equally strong disagreements within sociocultural anthropology, archaeology, and linguistics?

The question itself is an articulation of anthropology's status as an anachronism—with reference to both the Enlightenment and colonialism—as well as a framework for radically reconceptualizing difference. As the study of humankind as a discrete natural species, anthropology equivocates by focusing on differences and tallying totals in terms of a calculus of relativisms or, on a bad day, straightforward summation. What were once considered social and cultural differences on a scale that required specific disciplinary expertise to be understood have blurred into a global postcolonial matrix of variegated histories that can be much better understood in terms of mutated interdisciplinarity. Anthropology's value, however, is precisely a function of its Englightenment pretense: by taking humankind as its subject, it begs the question of delimitation and difference. In the post-Paleolithic present, biotechnology gives new relevance to this question.

On the first point mentioned by all five commentators I would, in general, agree: there are many opportunities for inter-subfield collaboration on topics that are rather "traditional and ordinary," as Cassidy and Mullin point out. However, I find two things somewhat problematic. First, the notion that any topic is "traditional or ordinary" to me screams of power—albeit with normative silence—and to accept those categories as such is to acquiesce in rather than interrogate power. Any attempt to bring different fields to bear on an analysis of topics such as "race," "domestication," and "medicine" must be critically aware that those topics exist, in part, as a function of a complex history that presents itself as traditional and ordinary and therefore is both that and anything but. Race, of course, is a prime example. I take this to be the central point of Corbey's remarks, which, above all else, re-

mind us of the lessons of history with regard to the blurring of boundaries and the power vested in trying to make categorization—of paradigms, humans, and metaphysical traditions—unambiguous. In any case, a very productive form of collaborative study, which is what I take Corbey and Cassidy and Mullin to be getting at, would be to bring different fields into dialogue in order to question the most basic assumptions of the categories we think with—race, species, medicine, kinship, evolution, psychology (to adapt a list provided by Cassidy and Mullin) as well as reciprocity, altruism, and biology (to adapt Corbey's list).

Second, I am all in favor of collaborative inter-subdisciplinary dialogue and collaboration, but I am even more interested in figuring out what subdisciplinary collaboration means. This is, fundamentally, the question that underlies Marks's question about what role biological anthropologists might play in my vision of a mutated four-field approach to the study of variably "human" primates. I have no definitive answer, except to say that I was inspired to write this essay, in part, by a number of recent works on primatology that problematize science and culture in ways that resonate with my own thinking on human selfhood and understanding. So, when Stanford points out that anthropology is a subfield of primatology—with a precise sense of what that means and how it will make people think—and when Marks points out that problematizing the category "human" makes the question of kinship critical, then I think we are in dialogue. I take this to be precisely linked to the valuable point made by Corbey in drawing attention to Lederman's notion of cultivating cross-subfield accents. As indicated by Cassidy and Mullin as well as Stanford, one place where these accents are strongest is in the area of cloning, genetic engineering, and organ transplantation, as well as in any situation in which biology is manipulated. To turn accented dialogue into collaboration is simply a matter of time, intellectual curiosity, and energy, and our disciplinary and subdisciplinary—not to say departmental—obligations and duties often chip away at these.

In addition to these general points there are some specific comments I would like to address. Cassidy and Mullen see a problem in my analytical focus on species differentiation and my reference to the way in which biotechnology in general has changed the way in which kinship relations are understood. They point out that species differentiation and recognition are not a problem of biotechnology but more a problem of categorization. I think this raises an issue of problematic elision: if one is concerned with biological and ecological classification—and even more so if one is a philosopher of biology—then species differentiation can be simply a theoretical problem of categorization. However, if one is concerned with evolution and human evolution in particular, species recognition and mate choice are not problems of abstract categorization at all. They are about successful reproduction. With the addition of culture, mate selection becomes a form of biotechnology, the technology in question being some degree of cultural consciousness. As is obvious and as the case Corbey cites from eighteenth-century Sweden makes clear, assisted reproductive technologies are but one manifestation of the way in which culture and sex can be experimented with. My point has to do with the mix of culture, sex, and species, and I see continuity between "natural" hybridization and futuristic biotechnology.

In different ways both Marks and Stanford raise an important point. My focus in this essay was on hybridization and the way in which hybridization complicates a calculation of descent, but clearly ecological adaptation is as important a factor in evolution as genetic similarity or difference. This provides a slightly different way to think about my central point: genetic manipulation will, ultimately, be the "easy part" in creating a human–nonhuman-animal hybrid. Along with ethical issues, the ecological dissonance that it will create will be much more difficult to anticipate and deal with. It is as though hybridization necessitated the creation of a new ecozone—a kind of global "third space" with a difference.

However, to return to my central point: would not the empirical fact of being confronted by a "monster" that violates the "natural order"—to use Corbey's terms—force another kind of dialogue with cross-species accents? And would not these accents of biosociality lay siege to the last bastion of Aristotelian essentialism? I will hold to my point that human-chimp hybridization will throw into question the meaning of being "human"—or of anything's being natural—in a much more radical way than might collaborative projects on the analysis of race, medicine, biology, or any other category in which nature and culture are "confused." I do not at all think that a chimp-human hybrid will represent empirical progress in science. As I have indicated, following Marks, the ethical issues are almost beyond the scope of the imagination, but the empirical fact of existence and the fact of existence as a consequence of real-time human intervention will, I think, make moot the question of how cautious or not one wishes to be on the issue of a prejudicially narrow *H. sapiens* reception to cross-species human plasticity. This is not to say that we will collectively greet our animal selves with open limbs, but it will force the question of who and what we are—biologically, morally, intellectually, psychologically, and politically (spirituality be damned, unless souls can be cloned)—into the inherently transgressive space of public culture.

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