

# *Chimeras*

## *From Poetry to Science*

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Not since the time of Hercules have there been so many chimeras abroad in the land. Of course, ours are rather different from the monstrous portents of Greek mythology. Some of ours really exist (like the mice with human neurons in their brains, or the “geep,” a combination of a goat and a sheep), although none of them breathes fire or even looks particularly frightening or strange. Others, like the genetically altered pigs who might serve as human organ factories or the “humanzee” (a combination of a human and a chimpanzee), belong to a possible future rather than a remote and legendary past. While both the pagan and the modern chimeras could be said to be man-made, the fundamental difference is that theirs were made by poetry, ours by science and technology. If “the wisdom of the ancients” is a phrase that has any truth, then it might be worthwhile to consider whether the poetic chimeras have anything to tell us about our new scientific versions, especially since we are in something of a quandary as to whether we should welcome or dread the coming of these biotechnological marvels.

Those most ready to embrace the field of chimeric research could be considered the modern descendants of Asclepius, the great physician, who according to legend was taught the art of healing by a chimeric creature, the wise and gentle Chiron. How oddly insightful this ancient account of the origins of medicine seems, now that science looks to chimeric creatures to reveal the mysteries of our biological functioning and to provide therapies for disease. The path to understanding and healing may indeed entail crossing certain boundaries between man and the animals.

The reason such boundaries are passable—or trespassable—is that the animals are, in fact, the “other” animals; in other words, men are animals, too (*zoon politicon*, perhaps, but *zoon* nonetheless), and there is a zoological continuum. We know that

nature herself does not always insist on the inviolability of natural kinds: chimeras and hybrids do occur naturally, though infrequently.<sup>1</sup> Moreover, the theory of evolution depends on the possibility of a sort of upward chimerization through the accidental acquisition of species-transforming characteristics.

We should not forget, however, that Asclepius was in the end struck dead by Zeus for daring to conquer death by bringing a man back to life. (We are told, by the way, that the famous physician undertook this resurrection for a large fee.) Apparently, it was not the mingling of animal and human being that provoked Zeus—after all, the king of the gods was known to assume animal form himself when it suited his purposes. Rather, what offended Zeus was the assault on the distinction between mortal beings (men) and immortal beings (gods). The anger of Zeus scarcely mattered to suffering and fearful mankind, who for centuries worshipped Asclepius as their benefactor, erecting temples in his name and honoring his sacred servant, the snake. (The caduceus, still the symbol of medicine, contains twin snakes entwined about a staff.)

The story of Asclepius expresses deep admiration for the medical enterprise along with an intuition about its dangers and temptations. On the negative side of the ledger is corruption by the promise of riches, the hubristic ambition to cure not disease, but death itself (an ambition whetted by the demands of patients), and the possibility that violations of the distinction between beast and man (say, by treating man simply as a biological being) might lead to the violation of the distinction between man and god. This last danger becomes even more acute if biological reductionism is understood in mechanistic terms. It may be paradoxical, but it seems that the class of men who reduce man in general to a machine thereby elevate themselves to the status of engineers and manufacturers. The reduction of man allows for the deification of the scientist.

While Chiron and his instruction of Asclepius represent the potentially beneficial aspect of chimeras, most of the Greek myths display a profound hostility to chimeras. Hercules in particular combats and slays many of the preposterously variegated monsters who were said to inhabit the earth in the earliest of days. Although I will refer to them generically as chimeras, only one of them—a she-goat with the head of a lion and the tail of a serpent—actually bore the name *Chimaera*. To understand the Greek view of these creatures and their meaning, a little genealogy

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<sup>1</sup> Although the terms *chimera* and *hybrid* are sometimes used interchangeably, in correct parlance a hybrid is the result of breeding two different species; each cell in the hybrid offspring mixes nuclear genes from the two parents. In contrast, the cells in a chimera are a mosaic of cells of the different species. A chimera has at least two different populations of genetically distinct cells originating from different zygotes (hence, chimeras are tetraparental or tetragametic). Tetragametic humans can occur naturally when the different zygotes of nonidentical twins happen to fuse together at an early stage in the womb. By implanting multiple embryos, IVF increases the chances of chimeric individuals being born. It seems likely that all of us have some degree of what is called “microchimerism” as a result of the transfer of cells between mother and fetus. Other types of microchimerism include blood transfusions and organ transplants.

might help.<sup>2</sup> Many of the most famous chimeric creatures were the offspring of Echidna (who was half woman, half snake and sister to Medusa and the Gorgons) and Typhon (who had one hundred heads, a feathered and winged body, and serpentine thighs). The pairing of Echidna and Typhon allowed for endless malleability and produced Chimaera, Hydra (whose multiple heads were capable of regeneration), the Gryphon vulture (part lion, part bird), Cerberus (the three-headed dog), and Orthus (another multi-headed dog, also known as Geryon's hound, who belonged to a three-bodied man). By an incestuous union with her son Orthus, Echidna bore the Sphinx (a lion with a human head) and the Nemean lion. Echidna's father was Phorcys, himself the son of Sea and Earth (Gaia), and hence an amphibious being. Typhon was the last offspring of mother Earth. She conceived him by Tartarus (the Underworld) with the hope that he would unseat the heavenly Zeus and avenge the defeat of her children the Titans. Typhon's hundred heads gave out a roar composed of the cries of a multitude of beasts (we still experience that blast of sound in a "typhoon"). Earth herself was born of Chaos; her last born, Typhon, seems to embody a chaotic plasticity. He has the pluripotency of teeming matter. His figure is an extreme amalgamation of the variety of animal shapes and voices (expressing a variety of internal dispositions and characters). Typhon is at once all creatures and no creature. Zeus himself killed Typhon. His death secured the triumph of the heavenly pantheon and established rational order over disorder.

The most popular of heroes, Hercules, completed the task of Zeus, killing many of Typhon's chimeric descendants. Hercules slew the Gryphon vulture, the Nemean lion, the Hydra, and Orthus; he kidnapped and subdued Cerberus, the watch-dog of Hades. Other heroes dispatched chimeric monsters too. Perseus killed Medusa; Bellerophon (riding the winged horse Pegasus) killed Chimaera herself.

In some ways, the Greek account is not so different from the account in Genesis 1, where God draws and makes firm the separations—between land, sea, and air, and between the beasts proper to each element—that render the world a cosmos, an intelligible whole. In Greek mythology, the movement is similarly from chaos to cosmos, accomplished by the insistence on elemental categories and species distinctions (with the added bonus of some great tales of the routing of multiform and disordered beings who fail to observe those categories and distinctions).

Interestingly, snakes figure prominently in both the Biblical and Hellenic accounts. Most of the Greek chimeras have a serpentine element (often the lower body, sometimes the hair). The first sign that Hercules, the future chimera-slayer, gave of his great destiny came when, as an infant, he laughingly strangled two giant snakes to death in his crib. The contrast between Hercules and Asclepius could not be more stark. The snake is the sacred servant of Asclepius, but the enemy of Hercules. Hercules is the son of Zeus; Asclepius is killed by Zeus. We might wonder

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<sup>2</sup>For information on the Greek myths, see Simon Hornblower and Antony Spawforth, *The Oxford Classical Dictionary* (New York: Oxford University Press, 2003), and Edith Hamilton, *Mythology* (New York: Signet Books, 1982).

what explains the linkage between Asclepius and the snake. The snake is the animal closest to the Earth (on his belly he goes), and medicine likewise stays close to the earth and earthly concerns. Medicine cares for bodily life. The snake might even be said to represent the abstract essence of embodiment, in that its body is so undifferentiated, being limbless and seemingly headless. The choice that medicine makes to serve the body (and that which is mortal) is reflected in the story of Asclepius's parentage. His human mother, impregnated by the god Apollo, abandons her divine consort for an earthly lover while Asclepius is yet unborn. For her infidelity, she is killed by the enraged Apollo, but Asclepius himself is plucked from her womb and saved. (It seems fitting that the first hero of medicine was born by cesarean section.) Like his father, the physician Asclepius seeks truth (Apollo is the god of truth), but like his divinity-rejecting mortal mother, he gives preference to earthly concerns (bodily health and longevity). Medicine pursues a highly particular slice of the truth.

Does this survey of Greek mythology offer us any guidance in thinking about our contemporary dilemmas? Although most of the Greek chimeras are threats to divine order and human happiness, not all of them are. Those that are portrayed more positively are those whose added parts might be said to represent poetic intensifications or enhancements of their natural species characteristics, rather than alien engraftings. In other words, they are not true or full chimeras. The watch-dog Cerberus would be a good example—his three heads graphically stress the alertness and astonishing peripheral vision of canines. Although ferocious, Cerberus is not vicious. Like any good working dog, he is faithful to the task to which he has been set. The same might be said of the winged horse, Pegasus; his wings are a poetic exaggeration of his fleetness. This is even the case with certain animal-human compounds, like the satyrs and sileni. These are beings with predominantly human form in whom bestial and licentious desires rule, as symbolized by certain goatish or equine bodily characteristics, usually ears, hooves, and tail. Their disorder, however, is not so much an intrinsic disorder as a behavioral disorder (they are usually in a state of drunkenness). Their wildness represents all-too-human failings. They are bestial, but not monstrous—and in the realm of the bestial, they are closer to domesticated beasts than wild. In the case of the centaur Chiron, where the rational element has the upper hand, the portrayal of a chimeric creature becomes unabashedly positive. (We should not forget, however, that Chiron was an exception among the centaurs; the rest of the race of man-horses was reputed to be savage.) Chiron is a model of the symbiotic working together of man and his most domesticated animal partner (the only rival to the horse in this respect would be the dog). A fine horseman firmly seated on a finely trained horse is Chiron-like, capable of feats of conquest and rescue that neither man nor beast could have accomplished on its own. The horse-man's ability to both conquer and rescue explains why Chiron is the teacher of both warriors and healers.

The vision of Chiron brings us back to the promise of scientific chimerization. Much of our contemporary chimeric research might be understood as an extension of domestication: the project of adapting life forms for the use and advantage of man. What hybridization is to agriculture, chimerization will be to medical science. Accordingly, I find that I do not object to the creation of human-nonhuman chimeras in cancer research and neural stem cell research (so long as non-embryonic human stem

cells are used). The reason I do not object is that the modified mice are not, strictly speaking, chimeras; they are pseudo-chimeras or, more accurately, chimeras at the cellular level, but not at the level of figure or temperament. This partial chimerization does not rise to the level of consciousness or physical appearance. It is a version of microchimerization. According to a recent article on the topic, the mixing that has been done so far (introducing small numbers of dissociated human stem cells into nonhuman animals or embryos) has not resulted in the “emergence of altered human-like features or functions in the nonhuman.”<sup>3</sup> Interestingly, the reason why the admixture of human material has not produced a new compound creature seems to be that species are fairly impervious to tampering. Monsters are not so easy to create. According to the article, “the overall architecture of the [host] animal’s brain would not be affected by the presence of these cells.”<sup>4</sup> Transplanting human neural stem cells into a mouse no more transforms the mouse than transplanting a pig heart valve into a person transforms the person. The rules that these authors recommend seem sensible, and—although the authors do not acknowledge it—those rules are based on preserving species integrity. Transfer the smallest number of cells necessary; use dissociated human stem cells rather than larger tissue transplants; and select host animals carefully: distant relations are to be preferred over our nearer primate cousins.

The kind of chimeric experimentation that might trigger ethical objections would be that in which the boundary tampering produces freakish beings something like the poetic chimeras of old, either through the imposition of parts that alter consciousness and external appearance or through the artificial union of gametes. In *Reproduction and Responsibility: The Regulation of New Biotechnologies*, the President’s Council on Bioethics spoke out forcefully in opposition to any attempt to create a true human-animal hybrid, like a humanzee.<sup>5</sup> It might be worth remembering that the mythological Minotaur, that murderous half-man, half-bull, was the offspring of Pasiphae, the queen of Crete, and a beautiful bull. In other words, the Minotaur was the monstrous issue of an act of bestiality. In calling for a prohibition on the production of a hybrid human-animal embryo by fertilization of human egg by animal sperm or of animal egg by human sperm, the council was simply calling for a ban on high-tech bestiality. One hopes that is one taboo still intact.

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<sup>3</sup> Phillip Karpowicz, Cynthia B. Cohen, and Derek van der Kooy, “Developing Human-Nonhuman Chimeras in Human Stem Cell Research: Ethical Issues and Boundaries,” *Kennedy Institute of Ethics Journal* 15.2 (June 2005), 124.

<sup>4</sup> *Ibid.* It does make one wonder how informative these experiments are if “the non-human host governs the way that these ... cells function” (125) and because of things like “host-mediated recruitment,” (125) the human cells become “the practical equivalent of mouse or monkey cells” (124). It seemed to me that the authors admit the limitations of these experiments when they say that “the human stem cell chimeras are not so much a test of characteristic human neural development, as a proof that human cells can contribute to a comparable, nonhuman animal’s development” (126).

<sup>5</sup> President’s Council on Bioethics, *Reproduction and Responsibility: The Regulation of New Biotechnologies* (Washington, DC: President’s Council on Bioethics, 2004), 220–221.

Most of the concerns that are raised today come from those who want to define and protect the boundaries of the human. Without dissenting from that necessary endeavor, I do want to suggest that the anthropocentric approach is incomplete. Reflection on the Greek chimeras raises doubts about nonhuman interspecies mixes as well. We should not forget that the original mythological Chimaera, who gives her name to these new biotechnological possibilities, was an altogether beastly mosaic—a she-goat with the head of a lion and the tail of a serpent. Our rather less indomitable version of the Chimaera is the geep. A geep was first produced in an American university laboratory in the 1980s by fusing sheep and goat embryos (like other chimeras, the geep has four parents).<sup>6</sup> Since each set of cells keeps its species identity, the result is a hodgepodge animal, with woolly (sheep) patches and hairy (goat) patches. Two creatures that made perfect sense in their own right were pointlessly mismatched. There has also been an authenticated case of the mating of a goat and a sheep resulting in a live birth.<sup>7</sup> Dubbed “the toast of Botswana” (after its place of origin), this intermediate hybrid animal (with fifty-seven chromosomes rather than the fifty-four of a sheep or the sixty of a goat) proved troublesome, for he mounted both goats and sheep in and out of season, earning himself the nickname Bemya, meaning “rapist.” Although infertile (like most hybrids), he had to be castrated.

Over the last two centuries, zoos, menageries, and circuses have repeatedly bred (or attempted to breed) various animal hybrids as curiosities. Particularly popular, and lucrative, were hybrid big cats, especially since certain crosses like the liger (male lion/female tiger) tend to gigantism, presenting the mouth-dropping spectacle of a wild cat the size of a small horse. While nature can be said to allow these crosses (since live births do occasionally result), the pairings usually require highly artificial conditions and varying degrees of human contrivance. Not only must mates of the same species be absent, but in some cases, one of the two (say a leopard) must have been entirely raised amongst the other species (say jaguars)—thus “imprinting” a new direction on the affections. If a female still resists her *faute-de-mieux* mate, resort is had to sedation. The achieved crossings are more numerous than the pre-Olympian monsters: there are ligers (male lion/female tiger) and tigons (male tiger/female lion), leopons (male leopard/female lion), jaglions (male jaguar/female lion), and jaguleps (male jaguar/female leopard), as well as li-jaguleps (male lion/female jagulep), ti-tigons, ti-ligers, li-tigons, and li-ligers.<sup>8</sup> Their fates, however, have been more pitiful than gruesome. In addition to the burdens of captivity (not one of these hybrids could survive in the wild), these animals experience psychological distur-

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<sup>6</sup> Wikipedia, s.v. “Geep,” <http://en.wikipedia.org/wiki/Geep>; Colorado State University, “Mosaicism and Chimerism,” general and medical genetics hypertext project, <http://arbl.cvmbs.colostate.edu/hbooks/genetics/medgen/chromo/mosaics.html>.

<sup>7</sup> Jonathan Amos, “‘Funny Creature’ Toast of Botswana,” *BBC News Online*, July 3, 2000, <http://news.bbc.co.uk/1/hi/sci/tech/813466.stm>; Phil Molyneux, “Toast of Botswana,” *Amazing Animals*, <http://www.greenapple.com/~jorp/amzanim/cross08a.htm>.

<sup>8</sup> Wikipedia, s.v. “Panthera Hybrid,” [http://en.wikipedia.org/wiki/Panthera\\_hybrid](http://en.wikipedia.org/wiki/Panthera_hybrid); “Tigons and Ti-Tigons,” *Loadstar’s Lair*, <http://www.lairweb.org.nz/tiger/tigons.html>.

bance and distress as a result of conflicting instincts, mixed vocabularies, and incompatible behaviors and ways of life. Lions are social; tigers are solitary. What is a liger or a tigon to do?

Judging from the betwixt-and-between life of the big cat hybrids, it would seem that transgenic creatures can find themselves displaced, uncertain of what form of animal happiness to pursue. The hybrid that is most common is the mule, and while mules are bred for legitimate reasons, other than idle curiosity, it may be that they are mulish for good reason. Recalcitrant and unruly mules deliver a deserved kick in the seat of the pants to their makers. (*Recalcitrant* derives from the Latin meaning “to kick back.”)

This record of experimental breeding is not encouraging. If there are now more scientifically sophisticated methods of creating both hybrids and chimeras, possibly making greater leaps across the boundaries of species, then there will be those who will want to try. Doubtless, some will do so with little regard for the species-specific character of animal flourishing. In pursuing projects of domestication, breeding in captivity, hybridization, and chimerization, we become responsible for the care of these altered and resituated creatures. If the obligations of stewardship are not enough to limit our actions, we should remember that wanton disregard for the needs and temperaments of different species can have dire consequences not only for the animals, but for man. Feeding sheep’s brains to cows (formerly a common practice in the animal feed industry) is as much a violation of species integrity as breeding sheep to goats. It should be no surprise that such appalling practices have given rise to a deadly affliction (“mad cow disease”) that migrated from sheep to cows to man. An ethics of animal husbandry ought to be a part of bioethics. Thinking about chimeras and hybrids may induce us to enlarge our conception of bioethics to take account of other life forms and the environments in which life exists. As all of life becomes increasingly subject to human control, will we return to the Typhonic chaos of mutilated and disordered beings? We have been forewarned by the poetic chimeras of the Greeks.