BETTER THAN HUMAN

The Promise and Perils of Enhancing Ourselves

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BREATHLESS OPTIMISM, HYSTERICAL LOATHING

It's too late to "just say no" to biomedical enhancements: They're already here and more are on the way. Consider the case of Michelle, a bright, ambitious junior at an elite U.S. university. To study more efficiently, Michelle takes Ritalin, a drug prescribed for ADD (attention deficit disorder), though she doesn't have ADD. Ritalin is only one of several drugs developed to treat disorders—including ADD, Alzheimer's dementia, and narcolepsy—that have been shown to improve thinking in people who aren't cognitively impaired. We already have cognitive enhancement drugs, and they are already widely used as such.

Michelle's boyfriend Carlos tells her she shouldn't take Ritalin. He says, "It's cheating and besides it might be dangerous." Michelle replies: "Calm down. It's just a cognitive enhancement drug—a chemical that helps me think better—it's not cocaine. Don't be hypocritical. You take a cognitive enhancement drug, too—probably in dangerously high doses—namely, caffeine. And don't think you're fooling me. You say you've quit, but I know you sneak a cigarette now and then when you're up late studying. I can smell it in your hair. Look, caffeine and nicotine both help you stay alert and think more clearly; that's why so many people use them. So if I'm cheating, so are you and a lot of other people. Besides, if you're worried about

unfair advantages, why pick on cognitive enhancement drugs? Just being at this university gives us a huge advantage. What do you think education is? It's cognitive enhancement. Or what about the fact that both your parents are really smart and have PhDs? That's certainly an advantage, too, and you didn't earn it. If I ever have kids, I want them to have the best opportunities I can provide for them. If this means making sure they've got good genes, then so be it. Biomedical enhancement? I'm all for it!"

"Wait a minute," Carlos protests. "Cognitive enhancement drugs, maybe. But now you're talking about genetically designing your children? It's one thing to use a drug to bring out a person's full potential. That's different from changing their nature, making them a different person than they would have been. That's playing God."

I've changed the names, filled out a few incomplete sentences, and corrected for the annoying tendency of undergraduates to punctuate every other phrase with "like." But otherwise this dialogue captures the gist of an exchange between two students in my class on the ethics of biomedical enhancement at Duke University.

Cognitive enhancement drugs are only the beginning. Biomedical science is producing new knowledge at an astounding rate—knowledge that will enable us, if we choose, to transform ourselves. Biomedical enhancements can make us smarter, have better memories, be stronger and quicker, have more stamina, live much longer, be more resistant to disease and to the frailties of aging, and enjoy richer emotional lives. They may even improve our character or at least strengthen our powers of self-control. Enhancement drugs are only part of the story. There's mounting evidence, including successful gene changes in laboratory animals, that human beings will eventually be able to change their physical, cognitive, and emotional capacities by deliberately modifying their genes. Eventually, we might even be able to take charge of human evolution.

A bit of terminology is in order. An *enhancement* is an intervention—a human action of any kind—that improves some capacity (or characteristic) that normal human beings ordinarily have or, more radically, that produces a new one. Cognitive enhancements increase normal cognitive capacities. Cognitive capacities include memory (of which there are several kinds), attention, reasoning, and what psychologists call "executive function," the ability of the mind to monitor, direct, and coordinate various mental operations. A *biomedical* enhancement uses biotechnology to cause an improvement of an existing capacity by acting directly on the body (including the brain).

Biomedical enhancements are contrasted with therapy, defined as the treatment or prevention of diseases. Modifying the genes of a human embryo to prevent a genetic disease would be therapy, not enhancement. Modifying an embryo to improve the normal immune system's capacity for fighting infections would be an enhancement. If we think of disease as an adverse departure from normal functioning, and therapy as aimed at preventing or curing disease, then the contrast with enhancement is clear: Enhancement aims to augment or improve normal functioning. In that sense, it aims to go beyond therapy.

Biomedical enhancements can be sorted out in two ways: according to the *type* of capacity they aim to improve, and according to the *mode* of intervention, the technology they use to improve the capacity. The types of capacities that biomedical enhancements can improve include cognitive function; physical strength, speed, and stamina; mood, temperament, and emotional functioning; and longevity. Enhanced longevity could be achieved either by bolstering the normal immune system to make us less vulnerable to diseases that shorten our lives or, more radically, by counteracting the normal processes by which cells age and eventually fail to regenerate.

The modes of biomedical enhancement include drugs; selecting which embryos to implant in the uterus by screening them for genes that are likely to result in better than normal capacities; implanting genetically altered tissue into the body or brain; genetically engineering human embryos (fertilized egg cells) or gametes (sperm or egg cells); and technologies that connect computers directly to the brain. All of these types and modes of biomedical enhancement have already been used successfully in laboratory animals, and some have been used in humans. Brain/computer interface technologies, for example, are already helping people who have lost their sight or their ability to move their limbs.

Before we go any further, I have to emphasize a simple point. An enhancement is an improvement of some particular capacity, but not necessarily something that makes us better off *overall*. For example, if your hearing were greatly enhanced, it might not improve your life. It might make you miserable, because you might not be able to concentrate due to all the noise. That's why it is better to talk about enhancing capacities rather than enhancing people. If we make the mistake of thinking that enhancing capacities makes us better off overall, we'll also mistakenly think, "Of course we should enhance—better is good!"

Even when an enhancement would make you better off overall, it doesn't follow that you should undertake it. Sometimes, the right thing to do isn't the thing that improves your own situation—especially if doing so wrongly disadvantages someone else or if the improvement comes at the cost of violating some important moral rule or has the effect of undermining your character.

The Michelle-Carlos dialogue encapsulates many of the issues about biomedical enhancement this book will explore. I want to tease out two of them right now. The rest will be examined in subsequent chapters.

The first is that as a society we face a choice between *front door* and *back door* biomedical enhancement. Biomedical enhancement comes through the front door when it makes its appearance as enhancement. This would occur, for example, if the Food and Drug Administration approved drugs that were designed for improving normal memory and were marketed as such. At present, biomedical enhancements don't come through the front door. They come through the back door, as spin-offs of efforts to treat diseases or disorders. That's true in Michelle's case. Ritalin is marketed and prescribed as a treatment for ADD, not as a cognitive enhancement drug. Michele can get her Ritalin in three ways. She can read the Wikipedia article on ADD, memorize the symptoms, and then tell the doctor at the student health clinic that she has them; she can "borrow" or buy the drug from somebody whose doctor prescribed it for him; or she can order it online from a virtual doctor (with some risk of getting a Ritalin knockoff or a watered down dose of the real thing).

There are lots of other cases where what begins as a treatment for a disease becomes an enhancement. Drugs called SSRIs (selective serotonin reuptake inhibitors), the most well-known of which is Prozac, were first developed to treat the disorder of clinical depression. But now millions of people who aren't clinically depressed take them to feel better. (In fact, my vet tells me that people ask her to prescribe it to their perfectly normal dogs to make them more cheerful.) Viagra was developed to treat EDD (erectile dysfunction disorder), but now lots of young men (including Carlos) take it so that they can perform like the Energizer Bunny, even when they're drunk. (Perhaps the most brilliant marketing strategy of recent times is the warning "If you experience an erection lasting more than four hours, seek medical attention.")

Sometimes people seek treatment and get enhancement as an unexpected bonus. For example, the latest high-tech prosthetics for

people who have lost a leg actually increase the capacity for rapid running—so much so that there is a movement to ban them from competitions. A few years ago, I had laser surgery on my eyes to correct for myopia—I didn't like wearing glasses and found contact lenses to be too bothersome. To my surprise, the doctor asked me if I wanted 20/20 vision or a bit better. Because I shoot targets with a pistol (for fun, not competitively), I opted for 20/20 vision in my left eye and a little better than that in my right, dominant eye. The result is that I can see the rear sight, the front sight, and the target more clearly at the same time, without shifting my focus to one and thereby blurring the other two. Having "normal" vision isn't optimal for all tasks, including target shooting.

Biomedical enhancements will keep coming in through the back door as long as we continue to make progress in treating diseases and disorders. So, just saying no to biomedical enhancements isn't really an option—unless we want to stop medical progress.

Yet if biomedical enhancements continue to come in through the back door, we'll have serious problems. Take Michelle's case. She and perhaps thousands of other students (and some professors) are taking a drug for a purpose for which it's not intended. There have been no clinical studies of the long-term use of Ritalin by people who don't have ADD. The worst-case scenario could be grim indeed. Ten years from now we discover that there's a serious adverse affect: People like Michelle develop some mental or physical problem. Ironically, some dimension of their cognitive performance gets worse; or they develop an emotional problem or personality disorder; or they suffer kidney or liver damage. So long as biomedical enhancements come through the back door, we won't be in a good position to evaluate their safety or even whether they really work for everybody who takes them.

The second issue the Michelle–Carlos dialogue raises is this: Just how novel are the problems biomedical enhancement raises? Michelle mentioned that cognitive enhancement drugs aren't new. We've had nicotine and caffeine for a long time. She also suggested that education is a cognitive enhancement technique. She could have gone further: Literacy is a fantastic cognitive enhancement. Being able to read and write greatly enhances what the human brain can do: Events and experiences can be recorded, and the record can be transmitted across vast distances and through the ages. We can make firm commitments in writing, avoiding some of the disagreements that would occur if we merely made oral pledges. We develop complex and enriching forms of discourse that wouldn't otherwise be possible. Each generation can build on the knowledge of previous ones, rather than having to start from scratch or depend on the vagaries of oral transmission.

Literacy and numeracy (mathematical skills) together have made possible perhaps the greatest cognitive enhancement to date: modern science. Computers and related technologies like smart phones are also awesome cognitive enhancements. They not only facilitate long-distance instantaneous communication, but also now include search engines like Bing, Google, and Yahoo that give us rapid access to vast amounts of information that we could never gain without them. Without computers the human genome couldn't have been sequenced and most medical research as we know it couldn't take place. Thanks to these nonbiomedical cognitive enhancements, human beings now have powers that our ancestors could only attribute to the gods.

These historical nonbiomedical cognitive enhancements don't just produce cognitive benefits. They produce wealthier societies; higher standards of living. They do this by making possible knowledge that can be applied to produce more food, better

shelter, more goods, and more services. And the great institutional enhancement we call the market both stimulates the production of these good things and helps make them more widely available at lower cost.

Cognitive enhancements tend to increase productivity, and although increased productivity isn't to be confused with greater well-being, it tends to be a necessary condition for it. An unenhanced world is a miserably poor world with a tiny human population.

The problem is that in current discourse, the term "enhancement" is usually attached only to interventions that involve biomedical technologies. This blinds us to how pervasive enhancements are in our lives and how central they have been to the origin and evolution of our species. It also tempts us to assume—without really thinking it through—that there's something radically more problematic about biomedical enhancements than other enhancements.

Biomedical enhancements do present challenges; we'll be grappling with them throughout this book. But to keep those challenges in perspective, it's important to avoid *biomedical enhancement exceptionalism*—the dogmatic assumption that because an enhancement involves biotechnologies (pills, computers, fiddling with embryos, etc.) it's somehow off the moral scale, that our ordinary moral tool kit is useless for coping with it. As an antidote to biomedical exceptionalism it's important to remember that human history—or at least human progress—is in great part the story of enhancement.

Let me elaborate on this last point for a moment. I've already mentioned literacy, numeracy, science, and computers, but the list of enhancements that have played a crucial role in human progress is much longer than that. Think about what historians call the agrarian revolution, which occurred between eight and ten thousand years ago in the Middle East: the development of food crops along with

the domestication of animals for plowing, transporting food, and as reliable sources of food, wool, and leather.

The first great effect of the agrarian revolution was that it enabled large numbers of people to live together year round. Before that, they lived in small, rather isolated groups and often had to move seasonally in search of food. Once large numbers of people could live together year round, they had to develop institutions—rule-governed patterns of behavior that greatly enhanced their capacities for social organization. We don't usually think of them in this way, but institutions are extraordinarily powerful enhancements.

The food surpluses the agrarian revolution produced made possible the division of labor; the development of commerce; leisure activities, and leisure goods and services ("luxuries"); the flourishing of arts and literature; and the development of government and with it the distinction between the public and the private sphere. The great nonbiomedical enhancements—institutions, literacy, numeracy, science—have made us who we are. You might even say they have shaped human nature.

Some people might protest that this isn't really progress. They pine for what they think of as the simplicity and harmony of an earlier kind of human life. For the past few decades, anthropologists have been chipping away at this idealized picture of the past—the notion that in premodern conditions human beings were peaceful, lived in harmony with nature, and were egalitarian. Those myths have now been shattered. In many scholarly articles and in books like *Sick Societies: Challenging the Myths of Primitive Harmony* by Robert Edgerton; *War Before Civilization: The Myth of the Peaceful Savage* by Lawrence H. Keeley; and *Collapse* by Jared Diamond, anthropologists have made a strong case that things weren't so good in the good old days. Some premodern societies committed suicide by ruining their environments; homicide rates among males in

premodern societies were astronomically high; and the treatment of women (and often children as well) was frequently brutal. Unfortunately, the makers of the popular film *Avatar* were oblivious to these scientific findings. Those who doubt that the great historical enhancements have made human beings better off overall should ask themselves whether they would choose to have themselves—or their daughters—transported back to a hunting-gathering society.

Biomedical enhancements have provoked huge controversy. Given that enhancement isn't new and that it has played a central role in human progress, what's all the fuss? Why should we tie our hands, cut ourselves off from further progress, by forgoing enhancements just because they happen to use biomedical technologies? The answer must be that there is something radically different and profoundly more problematic about these enhancements because they are biomedical. What could that be?

Let's try some alternatives: (1) biomedical enhancements are different because they change our biology; (2) biomedical enhancements are different because (some of them) change the human gene pool; (3) biomedical enhancements are different because they could change or destroy human nature; (4) biomedical enhancements are different because they amount to playing God.

Playing God

Let's take the last one first. I once asked a scientist who inserts genes into mouse embryos if he was worried about the common allegation that people like him are playing God. His response was: "I'm not *playing*; I'm deadly serious!" That sort of reply doesn't inspire confidence, but fortunately, the attitude it expresses doesn't appear

to be common among working scientists. And the scientist who made the remark laughed immediately afterward, indicating that what he said was tongue in cheek. The many scientists I've known have all been serious in the right way, and they don't come close to confusing themselves with the Deity.

The complaint about humans playing God isn't new, nor is it peculiar to biomedical enhancement. In the ancient Greek myth, Prometheus incurs the wrath of the gods because he gives fire to humans—the implication being that such a powerful technology is not suitable for mere mortals. The admonition not to play God is sometimes taken to be equivalent to "Don't interfere with nature." That's singularly unhelpful advice. As the philosopher John Stuart Mill pointed out 150 years ago, the term "nature" is ambiguous. It can mean the sum total of reality (including the laws of nature, for example, Force equals Mass times Acceleration). Or it can mean the way things would go without human action. In the first sense, the admonition not to interfere with nature isn't helpful, because we have no choice but to go along with nature. In the second sense, not interfering with nature would mean never acting and that, of course, isn't an option if we wish to live.

In the next two chapters we'll delve more deeply into whether the concept of nature or the natural can shed light on the ethics of biomedical enhancement. For now, the point I want to make is simply this: The slogan "Don't play God" is best understood as a warning against what the Greeks called hubris, over-weaning pride or being unjustifiably confident in our ability—in this case our ability to control our technologies.

That's good advice. But notice that it isn't just applicable to biomedical technologies; it applies to all technologies. Following this advice to be cautious *can't* mean never using any technologies. Refraining from using all technologies would betray either a desire

for extinction or an unwarranted arrogant confidence that we can live without them. So, although it's of course true that we should avoid playing God if this just means "Don't be hubristic," it's not very helpful for making concrete, practical decisions about which technologies to use or how to use them.

The "Don't play God" slogan certainly doesn't enable us to draw a bright line between biomedical enhancements and other technologies, since it applies to both. It's simply a very general plea for caution: It can't tell us *how* to be cautious or when we are being too cautious or not cautious enough. It doesn't help us distinguish between arrogant folly and a reasonable optimism in attempting to improve our lot in life. "Don't play God" is at best a starting point for difficult thinking about how to balance risks and benefits, but unfortunately, many people invoke it as a substitute for thinking.

Changing the Human Gene Pool

The first thing to note here is that most biomedical enhancements wouldn't change the gene pool, because they don't involve changing genes. So, perhaps the concern is with one kind of biomedical enhancement: the genetic engineering of human embryos. In a trivial sense, any case of trying to improve an individual's capacities by inserting a gene into the embryo from which he develops would be changing the gene pool. That is, one individual would have a gene he wouldn't otherwise have. Whether that minor change would produce a significant effect in the gene pool—the totality of individual human genomes—would depend on whether the genetically altered individual had many offspring, whether many of them survived, and whether (and on what scale) they reproduced. Enhancement via genetic engineering would only be likely to have a

significant effect on the human gene pool if either of two conditions were satisfied: Either a particular genetic alteration was undertaken on a very large scale, or an alteration undertaken on a small scale turned out to be highly beneficial in terms of reproductive fitness—that is, the gene spread through the human population over generations because having it greatly increased the chances of surviving and reproducing. In the latter case, altering the gene pool might be a good thing—for example, if the new gene protected us from emerging global pandemic diseases. So we shouldn't assume that changing the gene pool is always bad.

In 2001, the Council of Europe solemnly proclaimed that the human gene pool was the "common heritage" of mankind and therefore must be preserved. This declaration calls to mind the famous case of the ancient king of England, Canute, who commanded the waves of the ocean to cease. Talk about hubris.

The gene pool is changing all the time, through ordinary evolution, quite apart from deliberate human efforts to change it. Mutation of genes occurs randomly. Some mutations make it through the filter. So natural selection both presupposes and produces changes in the gene pool. The only way to preserve the human gene pool would be to store samples of everybody's genes and forbid any further reproduction.

The American bioethicist George Annas has gone the Council of Europe one better: He advocates changing international law to make genetic engineering of human embryos (for any reason, including enhancement) a "crime against humanity," to be prosecuted by the International Criminal Court. He too may be making the mistake of thinking that the gene pool is static unless altered by deliberate human intervention. At any rate, Annas is assuming not only that genetic enhancement would always be wrong, but that it would be so heinous as to warrant lumping it together with mass murder and

genocide. What he is worried about, as it turns out, is that if some people are genetically enhanced and others aren't, the enhanced will prey on the unenhanced—that they will ruthlessly exploit or even exterminate them.

It's hard to know what to think about this grim prediction. I consider it in detail in chapter 5, but for now let's just say that it seems like a pretty speculative worry. More precisely, it looks like a crude "slippery slope" argument, the idea apparently being that allowing any genetic modification would be so likely to result in a two-class world of prey and predators that we are justified *now* in treating anybody who undertakes any genetic modification, no matter how minor or benign, like Slobodan Milosevic. International lawyers worry whether the new International Criminal Court will become credible and survive. If they thought anyone would take Annas's proposal seriously, they'd be a lot more worried.

Taken literally, warnings about genetic enhancements changing the gene pool don't make sense because the gene pool is always changing no matter what we do. Nevertheless, maybe, as with the case of the slogan "Don't play God," these warnings gesture rather clumsily toward something that is genuinely important. Perhaps the real worry is that deliberate efforts to change human genes will wreak havoc with the "natural" process by which evolution, operating through natural selection, alters the gene pool.

Notice that this way of understanding the warning about changing the gene pool assumes that evolution is doing a good job and that our efforts are likely to make things worse. That assumption, as I shall show in chapter 2, is an unsupported dogma. Ironically, although it claims to be an objection to genetic enhancement based on evolution, it's really the product of a pre-Darwinian understanding of nature as teleological—that is, the view that "natural"

processes (so long as humans don't interfere with them) produce good results.

The father of evolutionary biology, Charles Darwin, thought otherwise. In a letter to his friend Joseph Hooker, he said so: "What a book a Devil's chaplain might write on the clumsy, wasteful, blundering, low, and horridly cruel works of nature!" Chapter 2 shows that this is not a cranky subjective judgment on Darwin's part: It's a characterization of nature that follows logically from an accurate understanding of evolution.

One last point about changing the gene pool. Only some biomedical enhancements necessarily involve changing the gene pool, namely, those that involve genetic engineering of human embryos or gametes (sperm or egg cells). But the great historical enhancements I described earlier have definitely changed the human gene pool in several ways. Here are four of them. First, the enhancement we call the agrarian revolution brought together large numbers of people in close proximity with each other and with animals such as pigs and chickens. This led to pathogens spreading not just from human to human but also from animals to humans (as with influenzas) and to epidemics. This changed the gene pool, because natural selection favored those who happened to have genes that conferred immunity to the diseases. Second, the great historical enhancements led to technologies and social institutions that facilitated migrations of peoples and long-distance commerce that brought previously isolated groups together. The result was that new combinations of genes occurred through old-fashioned, low-tech gene-splicing (i.e., sex). Third, the domestication of milk-producing animals led to selection of the genes associated with lactose tolerance. Because milk is a good source of fat and protein, being able to digest it confers an advantage in terms of reproductive fitness. But until some human societies developed the culture (no pun intended) of

dairying, the gene that allowed infants to digest milk normally "switched off" as they became older. Fourth, the historical enhancements created new patterns of human interaction and new roles that may have significantly influenced sexual selection. Sexual selection, like natural selection, shapes the gene pool. It occurs in two ways: Males compete with each other for access to females (think of bucks sparring with their antlers during the mating season), and females gravitate to certain males because of characteristics they have. In birds, bright plumage signals freedom from parasites and, hence, general vigor. Or, according to another theory, it signals that the male is so vigorous that it can escape predation despite the handicap of being highly visible to predators.

Sexual selection of both types in humans is influenced by culture, and culture is profoundly influenced by the historical enhancements. The tendency of women to opt for males they think will be good providers may not have changed over the millennia. But the traits that contribute to being a good provider presumably have changed, as humans switched from hunting and gathering to agriculture and later to a complex economy based on the manipulation of digitalized information.

What's the relevance of all this? It means that if there is a difference between biomedical enhancements and other enhancements, it can't be that biomedical enhancements change the human gene pool. To repeat: Not all biomedical enhancements involve modifying genes—only genetic enhancements do and then only under certain conditions—and the most important nonbiomedical enhancements *have* changed the gene pool. More important, it is wrong just to *assume* that deliberately changing the gene pool would be a bad thing. Whether it would or wouldn't be depends on how good a job nature is doing in its ceaseless modification of the gene pool. That's the topic of the next chapter, but Darwin's grim

assessment should at least give pause to those who think that natural is always best.

Changing Our Biology

Perhaps what makes biomedical enhancement so different—and especially problematic—is that it involves changing us physically or, more dramatically, that it alters our biology. Changing our biology certainly sounds like a big step, but what this would mean isn't so clear. Does drinking coffee change our biology? It does change our brain chemistry. If coffee doesn't change our biology, then why would one think that taking a cognitive enhancement drug in pill form would do so? What about genetic alteration of human embryos—would that count as changing our biology? That would depend on what sort of change was made. Some genetic changes might be fairly trivial, some might not be.

Oddly, human beings and only a few other mammalian species can't produce vitamin C from what they eat. In contrast, most mammals can "biosynthesize" this important chemical. The inability to biosynthesize vitamin C has caused huge problems for humans over the millennia. It still does for people who can't get enough vitamin C in their diet and can't afford or don't know about vitamin supplements. They get scurvy.

Humans can't make their own vitamin C because of a random mutation that occurred in our lineage about forty million years ago. So far as anyone can tell, there's no benefit that we gained from this change. Suppose that this could be corrected by genetic engineering—a paper has already been published explaining how it could be corrected in nonhuman animals. If that was the only change that was made, would it be helpful to say that human biology had

been changed? Well, in one sense it would be, but in another, this would be hyperbolic, since everything else would remain the same. The right question to ask isn't whether it would change our biology, but whether it would be a good thing.

That old-fashioned cognitive enhancement, literacy, changes the structure of the brain. Strangely, there's evidence that being literate actually changes the visual center of the brain with the result that we perceive the human face differently than our preliterate ancestors did. In fact, learning anything, by any method, alters the brain by creating new connections among brain cells. Cognitive enhancement drugs, in contrast, only make transient changes that disappear when you stop taking the drug. Similarly, a brain-human interface technology that improved our thinking would only produce biological changes when it was being used.

Many potential biomedical enhancements—from taking enhancement drugs to minor genetic alterations to tissue implants to computer/human interface technologies—wouldn't alter our biology in any significant sense. But if they did, that's really not the question, unless we have good reason to think that changing our biology is always a bad idea. Our biology is a product of evolution. As such, it has changed in the past and will change in the future, regardless of whether we undertake biomedical enhancements. The question is whether we might have good reasons for deliberately changing our biology in some respects.

Now the very thought of changing our biology may be repugnant to some people because they assume that our biology is what is natural and that the natural is the good. The quote from Darwin already calls that assumption into question. I'll shine an even harsher, colder light on the assumption that natural is good in chapters 2 and 3. Here I want to begin to consider a related question: whether biomedical enhancements would change (or even destroy) *human*

nature and, if so, whether that would be a bad thing. Answering that question will turn out to require a chapter, but for now we can at least begin to see why some people have thought it was the right question to ask about biomedical enhancements.

Changing or Destroying Human Nature

Francis Fukuyama, whose earlier book *The End of History* caused quite a stir for a time, wants a legal ban on genetic enhancement because it might inadvertently destroy that magical something that makes us human. I'll resist the temptation to say that, on the basis of his track record, we ought to be skeptical about Fukuyama's predictions. But it is perhaps worth mentioning that in his first book he wrongly predicted that the end of the Cold War would bring the end of ideology and hence of ideologically driven history. In doing so, he overlooked a few minor developments, including Islamic fundamentalism, the resurgence of socialism in parts of Latin America, and the clash between what some see as U.S. imperialism during the Bush administration and the commitment to the rule of international law, not to mention the rebirth of militaristic nationalism in post-Soviet Russia. Well, let's just set all that aside and consider his prediction about genetic enhancement on its own merits.

When people talk about human nature or what makes us human and in doing so assume that it is something precious that we ought not to imperil, they're taking a highly selective view of the subject. In fact, they are engaged in a whitewashing campaign of staggering proportions. After all, common sense and most major religions regard human nature as a pretty mixed bag. It includes awful as well as admirable features. In Christian terms, for example, although we are made in God's image, we are sinful by nature. As St. Paul puts it,

we are "filthy rags"—a sanitized English translation of a Greek phrase more accurately rendered as "used toilet paper." Surely, Fukuyama would have to admit that human nature includes the bad as well as the good. So his real concern must be that if we undertake genetic enhancements, we will inadvertently destroy the good parts of our human nature.

Extreme Connectedness: Throwing Out the Baby with the Bathwater

If Darwin is right—if nature, or more accurately evolution, often makes a mess of things, including us, and if we could straighten some of this out by biomedical interventions— then perhaps we could improve human nature. Fukuyama and others who want a ban on genetic enhancement must be thinking that if we try to ameliorate the bad parts of human nature we will inadvertently destroy the good parts. Let's call this the Extreme Connectedness Assumption. What I find fascinating is that, although the Extreme Connectedness Assumption seems to lie at the heart of the fear and loathing of genetic enhancement that one finds in some quarters, no one acts like it's even worth thinking about, much less supporting with evidence.

What sort of evidence would be relevant? The answer is clear: scientific evidence about what evolved organisms like us are like. In other words, we have to look to biology. The great geneticist Theodosius Dobzhansky famously said that "nothing in biology makes sense except in the light of evolution." As the eminent philosopher of science Philip Kitcher notes, that might be a bit of an exaggeration. Yet this much is clear: Understanding evolution is critical for evaluating the Extreme Connectedness Assumption. And evaluating the Extreme Connectedness Assumption is critical

for knowing how we ought to respond to the prospect of biomedical enhancement.

It shouldn't be surprising that in order to know whether in some instances genetic enhancement would be a good idea we need to know something about evolution. Yet those like Fukuyama and Annas who advocate a blanket prohibition on all genetic alteration of humans apparently don't agree. They think that from the smug comfort of their philosophical armchairs they can simply declare that all features of human nature are so closely interconnected that it would never be reasonable to try to ameliorate some of the worst features by altering genes. In chapter 2 I'll present a nontechnical but accurate account of some of the features of evolution that undermine the Extreme Connectedness Assumption. I'll argue that the baby and the bathwater can be separated.

Where We Stand So Far

My sense is that many people—perhaps the majority—are deeply concerned about the prospect of biomedical enhancements. The idea of trying to improve human beings by altering their genes—genetic enhancement—seems most worrisome of all. In fact, even the proposal to *consider* whether we should undertake genetic enhancements seems to elicit hysteria and loathing.

I haven't tried to argue for biomedical enhancements in general or for genetic enhancements in particular in this chapter. I'm just as leery of wild-eyed, Pollyanna-ish optimism about a "post-human future" as I am about knee-jerk, blanket rejections of biomedical enhancement. In my judgment, saying either that biomedical enhancements are an abomination or that they are wonderful would make about as much sense as being for or against technology or for

or against globalization. Those generalizations are just too big to be useful. Even if in the end we conclude that genetic enhancements are not acceptable, we shouldn't tar all enhancements with the same brush. Different types and modes of biomedical enhancements deserve to be evaluated on their own account. We need to steer a steady course between hysterical loathing and breathless optimism.

In this chapter I've begun to correct for what I take to be an imbalance in the public perception of biomedical enhancement—a sort of unreflective, default negative attitude toward it. To try to correct this imbalance, I've done two things. First, I've shown that enhancement isn't new. On the contrary, human progress has depended on enhancement. Second, I've shown that we should be wary of biomedical enhancement exceptionalism—of unthinkingly assuming that because an enhancement involves biomedical means, it must somehow be especially profound in its effects or especially morally problematic. The great historical enhancements—the agrarian revolution, institutions, literacy, numeracy, and computers—have affected us profoundly; they've radically transformed human life and made us who we are. (In fact, it isn't at all obvious that biomedical enhancements will have so great an impact; many almost certainly won't.) Also, every one of the historical nonbiomedical enhancements has created moral challenges—in many cases the same ones that biomedical enhancement will create. Neither the problem of bad unintended consequences, nor the worry about worsening existing injustices is unique to *biomedical* enhancements. In fact, these problems arise for technologies generally, not just enhancement technologies.

All this only scratches the surface. In subsequent chapters I burrow deeper. Chapter 2 shows how the debate about the ethics of biomedical enhancement looks if we take evolution seriously. Chapter 3 explores the widely held assumption that reflecting on human nature

can provide us with guidance in grappling with the ethical challenges of biomedical enhancement. Chapter 4 takes up the most serious worry about biomedical enhancement: the problem of unintended bad consequences. Chapter 5 probes the widely held belief that biomedical enhancements will exacerbate the problem of unfairness or distributive injustice. Chapter 6 examines a line of opposition to biomedical enhancement that is most closely identified with the work of Michael Sandel: the notion that the pursuit of enhancements both exhibits and contributes to vice—that is, bad character. The concluding chapter makes the case for embarking, cautiously and provisionally, on what I call the enhancement enterprise—meeting the challenge of biomedical enhancement head-on, rather than burying our heads in the sand and acting as if we can just say no.