

## Enhancing Brains: What Are We Afraid Of?

By Henry T. Greely, J.D.

*Editor's note: In 2008, Henry T. Greely, a professor at Stanford Law School, co-authored a commentary in Nature; it concluded that "safe and effective cognitive enhancers will benefit both the individual and society." The article inspired an impressive number of responses from readers, and the debate has continued in scholarly journals and the mainstream media in the years following publication. Here Professor Greely builds on that momentum, arguing that only some concerns about cognitive enhancements are justified and proper attention is needed to address such issues. He contends that rather than banning cognitive enhancements, as some have suggested, we should determine rules for their use.*

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In December 2008, I was the first author on a paper in *Nature* called “Towards Responsible Use of Cognitive-Enhancing Drugs by the Healthy.”<sup>1</sup> We argued that there was nothing inherently wrong with the use of drugs for cognitive enhancement, although issues of safety, fairness, and coercion will require attention. I received far more communications about that article than about anything else I have ever written. About one-third of them were thoughtful responses, some in favor of cognitive enhancement and some opposed. Another third said, roughly, “How much crack were you smoking when you wrote that?” The last third said, also roughly, “How much money did large drug companies pay you to write that?” (I kept waiting for “How much crack did large drug companies give you to write that?” but, alas, that question never came.) In spite of what some of my correspondents seemed to think, the article had not called for putting stimulants into the water supply. We thought we were taking an open-minded but cautious approach to the issue. So, what prompted this strong response and what, if anything, can we learn from it?

Probing that question is my ultimate aim in this article, but we will get there somewhat indirectly. I will first make an affirmative argument for cognitive enhancement through drugs or other neuroscientific interventions. Then I will talk about concerns, both appropriate and inappropriate, about these kinds of enhancements. Only then will I try to understand the strong negative reactions to our paper and what we might learn from them.

Note first, though, that this is largely a hypothetical discussion, as cognitive enhancement remains largely in the future. Current, direct brain interventions for the purposes of cognitive enhancement are few and far between, comprising mainly a few stimulant drugs of unclear (but clearly not enormous) effectiveness and uncertain risks. Yet the explosion of our knowledge of the human brain—and the scores of billions of dollars being invested in discovering treatments for brain-based ailments, some of which are likely to spin off enhancement products—convince me that these issues will be substantial, perhaps in this decade and likely in the next.

### **Why Cognitive Enhancement—and What Kinds of Enhancements?**

We want to enhance our brain for the same reason we want to enhance anything else: to make it work better. At the risk of tautology, enhancing something *means* making it better. The current controversy is about what I call direct biological cognitive enhancements—chemical, physical, or electromagnetic intrusions *into* our physical brains. Drugs certainly qualify, but so

do brain surgery, direct brain stimulation, microelectrode insertions, transcranial magnetic stimulation, and a variety of other possible interventions made newly possible, or newly plausible, by advances in neuroscience. All were developed for therapeutic purposes, but many have potential uses for enhancement.

Of course, we have been engaged in less-direct cognitive enhancement for a long, long time. Language may have been our first crucial cognitive enhancement as a species. A few millennia ago, we added writing, an enhancement that dramatically improved our cognitive abilities to remember, to learn, and to communicate. The list stretches to the Internet and beyond.

Some might object that these are tools, not enhancements. But our tools *are* enhancements. Like everything else we do, tool use changes our brains. Literacy changes how our brains function and the physical layout of our synapses and circuits; so, no doubt, does Google. Although it may be useful to distinguish between “tool enhancements” and “direct brain enhancements”, we always need ask why—and whether—it matters if we improve our brains through a keyboard or by drugs, deep brain stimulation, or neurosurgery.<sup>2</sup>

### **What Should We Worry About?**

Many people find direct brain enhancement frightening. There are some good reasons for concern, though not, I think, for fear; other worries about these technologies are unsubstantiated. The three issues I worry about are safety, fairness, and coercion.

We have at least some vague idea of the risks of existing enhancement technologies, not from large, systematic studies, which don't exist, but because we have seen them in widespread use. Furthermore, tool enhancements seem less likely than direct enhancements to have dangerous effects on the brain. An enhancement that works through the visual system, for example, is unlikely to pose substantial new kinds of safety risks (although there may be exceptions, such as flashing patterns that might trigger epileptic seizures). Given the awesome complexity of the human brain and our still very limited understanding of it, we *should* be worried about the effects of new drugs or new methods of brain stimulation or surgery designed to enhance the brain.

The way such enhancements are likely to be regulated should magnify our concern. I expect most of these enhancing technologies to be developed not for the purpose of enhancement but as treatments for illness or deterioration. In the United States, drugs, biological products, and most high-risk medical devices can be sold only after the Food and Drug Administration (FDA)

has been convinced that they are both safe and effective. The FDA, however, makes that decision in the context of one particular proposed use. This makes perfect sense—a drug that instantly cures half of the people treated and quickly but painlessly kills the other half would be seen as acceptably safe and effective as a treatment for metastatic pancreatic cancer, but not for treating acne.

Once the FDA approves a new drug, biologic, or medical device, a physician may legally prescribe it for any use, even though that use may never have been proven safe or effective. This approach to “off-label use” will mean that, at least as far as the FDA is concerned, approved drugs, biologics, and devices can be used for enhancement purposes where neither the safety nor the efficacy is known and where the balance of benefit and risk may be quite different. (Professional standards and potential malpractice liability do provide some constraints.)

Even worse, some non-drug methods of cognitive enhancement will receive no FDA review. The FDA has no jurisdiction over new surgical techniques using approved drugs and devices; no one has to prove in advance that these techniques are safe and effective. Medical devices that the FDA does not consider high-risk, or that are “substantially similar” to existing devices, get only minimal review. Dietary supplements are almost completely unreviewed when they are purported only to affect the “structure or function” of the body—as would be the case with cognitive enhancements—and not to treat disease.

Off-label use is already a problem. Amphetamine and dextroamphetamine (Adderall) and methylphenidate (Ritalin) are drugs prescribed to millions of Americans to treat attention deficit disorder (ADD) or attention-deficit/hyperactivity disorder (ADHD). They are also widely used on college and high school campuses as “study drugs” to help students without an ADD or ADHD diagnosis fight off sleep and focus better on their work. A survey in 2008 showed that four percent of 1,800 randomly surveyed students at a large public university had prescriptions for Adderall or Ritalin; another 34 percent of the students (including more than half of the juniors and seniors) had used the drugs without a prescription, almost all of whom said they took it to help them study.<sup>3</sup> Yet we have few, if any, good studies of the safety and efficacy of these drugs when students use them without a prescription to try to improve their educations (or at least their grades).

Future cognitive enhancements will only make this problem worse. Like any interventions, they will have varying risks and benefits, yet our current regulatory scheme would require no testing for some kinds and very little testing for others. Even for drugs, the most

regulated kind of enhancement, testing would cover only therapeutic uses in people who are ill, not their enhancing uses in people who are healthy.

What can we handle this problem? We could put our hopes in malpractice liability to limit prescriptions (though that will not prevent patients from reselling the drugs or giving them to their friends). We could try, with scant chances of success, to ban the use of all cognitive enhancements because of safety concerns. Or we could require better research on, and better regulation of, cognitive enhancements.

Fairness concerns also demand attention. New, effective cognitive enhancements could add to existing questions. Is it fair for one student to take an exam after studying all night using Adderall when another student has not taken the drug? Is it fair for one student to take the exam after nighttime studying fueled by double espressos or energy drinks? Is it fair for one student to take the test after receiving tutoring that another could not afford, or after using a computer or a computer program that the other did not have?

There is a broader question of fairness here. If direct cognitive enhancements really work, and if they are expensive, presumably only the rich will have access to them. This is the new face of an old concern. The single greatest current cognitive enhancing technology is primary education, particularly literacy and arithmetic. Not long ago, even in rich countries, primary education was generally unavailable to the children of the poor. Now almost every country makes free primary (and usually secondary, and sometimes tertiary) education available.

Cognitive enhancements need not lead to unfairness. If limited access to effective cognitive enhancement is a problem, we probably could manage it much better by making enhancements available to everyone than by trying, probably unsuccessfully, to prohibit them to anyone. If we felt that this remained unfair to those who chose not to use enhancements, teachers could institute different grading curves for “enhanced” and “unenhanced” students. And note that if students do learn better using direct brain enhancements with low risk, both they and the world are presumably better off because they are better educated.

Finally, we must consider coercion. Should we allow people to be forced to undergo direct cognitive enhancement? The example of free education suggests one answer: Sometimes we should. Countries make primary education not only universally accessible but universally compulsory. Some enhancements might be so safe and so powerful that, like reading, writing, and arithmetic, they should be required.

Short of that, though, should we put limitations on coercion? Employers often force employees to attend workshops or take courses to improve the employees' performance, without any real evidence that such interventions are either safe or effective. Should an employer be allowed to say, "Take these memory-improving pills or you will be fired"? Should the military be able to say, "Take these alertness-improving pills or you will be court-martialed"?

Most difficult, should parents be able to coerce their children to use direct brain enhancements? We give parents very broad scope in decisions about raising their children; Supreme Court has ruled that the Constitution protects parents' rights to make some such decisions. Yet that discretion is not endless; at some point, child protective services can be called and parental discretion overruled. Where should we draw the line with parents seeking to improve their children's brains?

These questions about coercion, like those regarding safety and fairness, do not lend themselves to definitive answers. Good answers will doubtless depend on the enhancement technology and on the social circumstances. But we need to begin to come up with answers, and soon.

### **What Shouldn't We Worry About?**

There are at least three unsound reasons for concern: cheating, solidarity, and naturalness.

Many people find the assertion that enhancement is cheating to be convincing. Sometimes it is: If rules or laws ban an enhancement, then using it is cheating. But that does not help in situations where there are no rules or the rules are still being determined. The problem with viewing enhancements as cheating is that enhancements, broadly defined, are ubiquitous. If taking a cognitive-enhancement drug before a college entrance exam is cheating, what about taking a prep course? Using a computer program for test preparation? Reading a book about taking the test? Drinking a cup of coffee the morning of the test? Getting a good night's sleep before the test? To say that direct brain enhancement is inherently cheating is to require a standard of what the "right" competition is. What would be the generally accepted standard in our complex and only somewhat meritocratic society?

The idea of enhancement as cheating is also related to the idea that enhancement replaces effort. Yet the plausible cognitive enhancements would not eliminate the need to study; they would just make studying more effective. In any event, we do not reward effort, we reward

success. People with naturally good memories have advantages over others in organic chemistry exams, but they did not work for that good memory.

Some argue that enhancement is unnatural and threatens to take us beyond our humanity. This argument, too, suffers from a major problem. All of our civilization is unnatural. A fair speaker could not fly across a continent, take a taxi to an air-conditioned auditorium, and give a microphone-assisted PowerPoint presentation decrying enhancement as unnatural without either a sense of humor or a good argument for why these enhancements are different. Because they change our physical bodies? So do medicine, good food, clothing, and a hundred other unnatural changes. Because they change our brains? So does education. What argument justifies drawing the line *here* and not *there*? A strong naturalness argument against direct brain enhancements, in particular, has not been—and I think cannot be—made. Humans have constantly been changing our world and ourselves, sometimes for better and sometimes for worse. A golden age of unenhanced naturalness is a myth, not an argument.

### **Why Do People Care So Much?**

So why did I get all those odd e-mails? Why do people care so much about this? I do not have any good social-science data, but I want to suggest some ideas that seem plausible.

First, the cognitive enhancements we have today are stimulants. Some stimulants are drugs of abuse, illegally used to get high, and these can be very risky. Adderall is a combination of several kinds of amphetamines; other enhancing stimulants similarly provide alertness and attention. The currently available direct brain enhancements are not only weak and, when used off-label, of uncertain safety, but they are a socially stigmatized kind of product. I suspect that people will be more accepting when the cognitive enhancer is a drug that boosts memory, or a little electrical stimulator that sticks to the scalp.

Second, some people compare cognitive enhancement to steroids, human growth hormone, and “blood doping” in sports. Just as the latter are wrong, they urge, so is the former. It is not at all clear to me that enhancement in sports *is* wrong, except to the extent that it is against the rules of particular sports and breaking the rules is wrong. Top-level athletes are enhanced by training, conditioning, equipment, nutrition, coaching, and psychological counseling, among other things. The case for singling out performance-enhancing drugs as *the* bad enhancement in sports has the same problems as the case against cognitive enhancement.

But I do want to suggest two ways sports are different. First, the competition is more direct. One wrestler will win the gold medal, the other the silver. Perhaps in that context fairness requires more evenness—though, of course, that does not tell us whether the competitors should be equally pure or equally enhanced. Second, although I love them dearly, sports are entertainment. The world is not better or worse depending on who wins an Olympic gold medal, the Super Bowl, or the World Cup. The world may well be better off if more brains are enhanced, if more people are learning and thinking more effectively. Granted, it is an unprovable assumption—perhaps just a bias—that a world with smarter people would be a better world, but in some areas, such as biomedical research, the assumption seems fair. Better medical treatments, developed and delivered sooner, relieve human suffering and improve the world. A new weight-lifting record does not.

Third, some people feel threatened by cognitive enhancements. They fear that, in order to compete in their world, they will need to add enhancing drugs to 24/7 smart-phone access, 80-hour workweeks, and disappearing vacations. This is not an irrational fear, but it is probably not widespread. Most Americans do not work 80-hour weeks, constantly searching for the next competitive advantage. Most of the country has found comfortable, or at least acceptable, compromises between work and the rest of life. For some, cognitive enhancement may not be required in order to run faster just to stay in place. It may be a way to do the same, fixed amount of work in less time, providing more free time, not less. For driven people, the problem is not in their tools but in themselves. Safe and effective cognitive enhancement might add yet one more pathway to unhappiness, but it will not cause unhappiness.

Fourth, the kinds of enhancements we are talking about are, for the most part, new. One of the exceptions is revealing. Few people worry much about using caffeine, yet it is a cognitive-enhancement drug that comes with risks. In a large enough dose, it can even be fatal. (The fatal dose would require drinking about a hundred cups of coffee in a short time period, though deaths have been reported from an overdose of caffeine pills.) We are more comfortable with longstanding enhancements than with newer ones. Only part of that comfort is that we are more aware of the benefits and the risks of the older enhancements and the ways they are used. Even if a new, direct brain enhancement were demonstrated beyond a doubt to be safe and effective, its newness would evoke discomfort.

Finally, some people worry about where this will all end, projecting a path from Adderall to a human/computer cyborg. We cannot, of course, confidently predict where these technologies

will lead. We can see blurred visions of the next decade or two; we can see almost nothing at all about the next century, let alone the next millennium. Mankind may change dramatically and cognitive enhancements may turn out to play a crucial role in that transformation. Or maybe not. I would suggest only that if we should develop safe and effective direct brain enhancements, we should not reject them for fear of where they may lead in a distant future. Future applications will be the problems, and the decisions, of our grandchildren and their grandchildren, who will have the benefit of more knowledge both of the technologies involved and of their culture's views of those technologies. For us to think that we can, today, make better choices for them based on almost no information about the questions they will face is hubris.

### **In Conclusion – “It Depends”**

As in the *Nature* article, I have not argued here that direct brain enhancements are good, let alone that they should be added to the water supply. I have argued that they are not necessarily bad. Their appropriate use will depend on their safety and effectiveness, along with how we choose to use them and what steps we take to mitigate the challenges to fairness they may pose or the invasions of individual autonomy they may provoke.

Biomedicine will be creating more and more products and procedures that can be used for cognitive enhancement. Some of them will be used in ways that will, on balance, improve human life and society. At the same time, I worry that they may be used in harmful ways. I am confident, though, that a knee-jerk rejection of all direct brain enhancements will be at least a missed opportunity and at worst an opening for a damaging underground and uncontrolled world of enhancements. In order to maximize the benefits and minimize the harms of these new technologies, we will need to look at particular enhancements rationally and to adopt, ban, or regulate them carefully. On this, much depends.

**Henry T. Greely, J.D.**, is the Deane F. and Kate Edelman Johnson Professor of Law and professor (by courtesy) of genetics at Stanford University. He specializes in ethical, legal, and social issues arising from advances in the biosciences, including neuroscience, genetics, and human stem cell research. He chairs the California Advisory Committee on Human Stem Cell Research and the steering committee of the Stanford University Center for Biomedical Ethics, and he directs the Stanford Center for Law and the Biosciences. From 2007 to 2010 he was a co-

director of the Law and Neuroscience Project. In 2006, he was elected a fellow of the American Association for the Advancement of Science.

## **References**

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