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How Science Can Build a Better You

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IF a brain implant were safe and available and allowed you to operate your iPad or car using only thought, would you want one? What about an embedded device that gently bathed your brain in electrons and boosted memory and attention? Would you order one for your children?

In a future presidential election, would you vote for a candidate who had neural implants that helped optimize his or her alertness and functionality during a crisis, or in a candidates' debate? Would you vote for a commander in chief who wasn't equipped with such a device?

If these seem like tinfoil-on-the-head questions, consider the case of Cathy Hutchinson. Paralyzed by a stroke, she recently drank a canister of coffee by using a prosthetic arm controlled by thought. She was helped by a device called Braingate, a tiny bed of electrons surgically implanted on her motor cortex and connected by a wire to a computer.

Working with a team of neuroscientists at Brown University, Ms. Hutchinson, then 58, was asked to imagine that she was moving her own arm. As her neurons fired, Braingate interpreted the mental commands and moved the artificial arm and humanlike hand to deliver the first coffee Ms. Hutchinson had raised to her own lips in 15 years.

Braingate has barely worked on just a handful of people, and it is years away from actually being useful. Yet it's an example of nascent technologies that in the next two to three decades may transform life not only for the impaired, but also for the healthy.

Other medical technologies that might break through the enhancement barrier range from genetic modifications and stem-cell therapies that might make people cognitively more efficient to nano-bots that could one day repair and optimize molecular structures in cells.

Many researchers, including the Brown neuroscientist John Donoghue, leader of the Braingate team, adamantly oppose the use of their technologies for augmenting the nonimpaired. Yet some healthy Americans are already availing themselves of medical technologies. For years millions of college students and professionals have been popping powerful stimulants like Adderall and Provigil to take exams and to pull all-nighters. These

drugs can be highly addictive and may not work for everyone. While more research is needed, so far no evidence has emerged that legions of users have been harmed. The same may be true for a modest use of steroids for athletes.

Which leads us to the crucial question: How far would you go to modify yourself using the latest medical technology?

Over the last couple of years during talks and lectures, I have asked thousands of people a hypothetical question that goes like this: "If I could offer you a pill that allowed your child to increase his or her memory by 25 percent, would you give it to them?"

The show of hands in this informal poll has been overwhelming, with 80 percent or more voting no.

Then I asked a follow-up question. "What if this pill was safe and increased your kid's grades from a B average to an A average?" People tittered nervously, looked around to see how others were voting as nearly half said yes. (Many didn't vote at all.)

"And what if all of the other kids are taking the pill?" I asked. The tittering stopped and nearly everyone voted yes.

No pill now exists that can boost memory by 25 percent. Yet neuroscientists tell me that pharmaceutical companies are testing compounds in early stage human trials that may enable patients with dementia and other memory-stealing diseases to have better recall. No one knows if these will work to improve healthy people, but it's possible that one will work in the future.

More intriguing is the notion that a supermemory or attention pill might be used someday by those with critical jobs like pilots, surgeons, police officers — or the chief executive of the United States. In fact, we may demand that they use them, said the bioethicist Thomas H. Murray. "It might actually be immoral for a surgeon not to take a drug that was safe and steadied his hand," said Mr. Murray, the former president of the Hastings Center, a bioethics research group. "That would be like using a scalpel that wasn't sterile."

HERE is a partial checklist of cutting-edge medical-technology therapies now under way or in an experimental phase that might lead to future enhancements.

More than 200,000 deaf people have had their hearing partially restored by a brain implant that receives sound waves and uses a minicomputer to process and deliver them directly

into the brain via the cochlear (audio) nerve. New and experimental technologies could lead to devices that allow people with or possibly without hearing loss to hear better, possibly much better.

The Israel-based company Nano Retina and others are developing early-stage devices and implants that restore partial sight to the blind. Nano Retina uses a tiny sensor backed by electrodes embedded in the back of the eye, on top of the retina. They replace connections damaged by macular degeneration and other diseases. So far images are fuzzy and gray-scale and a long way from restoring functional eyesight. Scientists, however, are currently working on ways to mimic and improve eyesight in people and in robots that could lead to far more sophisticated technologies.

Engineers at companies like Ekso Bionics of Richmond, Calif., are building first-generation exoskeletons that aim to allow patients with paralyzed legs to walk, though the devices are still in the baby-step phase. This summer the sprinter Oscar Pistorius of South Africa proved he could compete at the Olympics using artificial half-leg blades called Cheetahs that some worried might give him an advantage over runners with legs made of flesh and blood. Neuroscientists are developing more advanced prosthetics that may one day be operated from the brain via fiber optic lines embedded under the skin.

For years, scientists have been manipulating genes in animals to make improvements in neural performance, strength and agility, among other augmentations. Directly altering human DNA using “gene therapy” in humans remains dangerous and fraught with ethical challenges. But it may be possible to develop drugs that alter enzymes and other proteins associated with genes for, say, speed and endurance or dopamine levels in the brain connected to improved neural performance.

Synthetic biologists contend that re-engineering cells and DNA may one day allow us to eliminate diseases; a few believe we will be able to build tailor-made people. Others are convinced that stem cells might one day be used to grow fresh brain, heart or liver cells to augment or improve cells in these and other organs.

Not all enhancements are high-tech or invasive. Neuroscientists are seeing boosts from neuro-feedback and video games designed to teach and develop cognition and from meditation and improvements in diet, exercise and sleep. “We may see a convergence of several of these technologies,” said the neurologist Adam Gazzaley of the University of California at San Francisco. He is developing brain-boosting games with developers and engineers who once worked for Lucas Arts, founded by the “Star Wars” director George

Lucas.

Which leads to another question: How far would you go to augment yourself? Would you replace perfectly good legs with artificial ones if they made you faster and stronger? What if a United States Agency for Human Augmentation had approved this and other radical enhancements? Would that persuade you?

Ethical challenges for the coming Age of Enhancement include, besides basic safety questions, the issue of who would get the enhancements, how much they would cost, and who would gain an advantage over others by using them. In a society that is already seeing a widening gap between the very rich and the rest of us, the question of a democracy of equals could face a critical test if the well-off also could afford a physical, genetic or bionic advantage. It also may challenge what it means to be human.

Still, the enhancements are coming, and they will be hard to resist. The real issue is what we do with them once they become irresistible.

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