

Quote to note

"Are we going to allow the industrialisation of Life itself, redesigning the natural world for the sake of convenience and embarking on an Orwellian future? And, if we do, will there eventually be a price to pay?"

— Charles, Prince of Wales

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Genetically modified organisms

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Debate among policy makers and experts about genetically modified organisms has tended to frame the issue in terms of risks and benefits; this circumscribes the role of values in the debate and transforms the issue into a largely scientific one that should be restricted to experts. Scientists tell us what the benefits and risks are and whether the new technology is worthwhile. Critics often respond by noting that values can play at least some role even within this framework. The questions of how much risk is too much, what sorts of benefits are worthwhile and to what extent are they valued, and, above all, how much uncertainty is acceptable, are all issues that allow values to be introduced. Even so, the role of values is fairly limited in this way of framing debates.

There is little doubt that the creation of genetically modified organisms can offer many advantages. Current genetically modified organisms have included crops that are largely of benefit to farmers and are not clearly of broad public value. That situation will soon change as future genetically modified organisms will include: foods that have far greater nutritional benefit, crops that can grow in regions with poor soil that currently cannot support subsistence agriculture, cattle whose milk offers pharmaceutical benefit, foods that are more desirable in terms of traits that the public wants (e.g., Brussels sprouts that taste like chocolate). The market forces that largely determine which of these products are developed are

complicated. For example, the traits that may be needed to feed a starving world are different than the traits that farmers in the United States want, and both may differ from the characteristics that the paying public supports.

Most criticisms have focused on two issues. First, there is concern about food safety. What impact will genetically modified organisms have on the health of those who eat them? The new technology makes it possible to cross species barriers with impunity. Will a shellfish gene placed in a tomato cause allergic reactions? The recent scare over StarLink corn is instructive. "Bt corn," a common genetically modified organism, includes a gene from *Bacillus thuringiensis*, which produces a pesticide that kills the European corn borer. One of the problems with Bt corn is that it is likely that insects will soon develop resistance. StarLink is a new variation of Bt that includes a protein, Cry9C, that does not break down as easily in the body. It may therefore postpone resistance. However, it also has some characteristics of food allergens.

The fact that it will remain in the body longer increases the risk of allergic reactions (though there are no verified cases). StarLink corn was approved for animal feed, but not for human consumption. It is difficult, if not impossible, to keep the food supply for animals and humans separate. The feed is often in the same silos and at least some of the corn from one field can send seed to another.

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Implantable brain chips — will they change who we are?

What are your boundaries? Where do you stop and where does the world begin? If you are a violinist, your bow is already an eloquent, feeling part of you. If you drive race cars, you feel the grip of the tires on the road as if you were running barefoot. If somebody steals your eye-glasses, you are temporarily disabled as surely as if they punch you in the eye. Take away my computers and I might as well have brain damage.

The skin is an important membrane, for most purposes the natural boundary between a person and the rest of the world, but it lost its role as the edge of agency when our ancestors first began to make and use tools. Is there really that much difference between a tool you put inside your body and a tool you enclose in the palm of your hand or wear on the bridge of your nose? Most, if not all, of the conceptual issues — the ethical dilemmas and the other deep revisions in our way of life — have already been confronted time and again, in simpler versions. Implantable brain chips — if they really do become widespread (which I doubt) — will intensify problems and opportunities we are already trying to cope with. Will this intensification move us into altogether new territory? Let's consider the prospects.

Predictions about the spread of new technology have a dismal track record, so we will probably both overestimate some problems and underestimate others by a wide margin. But we should try. McGee and Maguire (*Labey Clinic Medical Ethics Newsletter*, Winter 2001) say “these enhancements will produce major improvements in quality of life or in job performance,” and although they probably didn't mean “or” to be exclusive, it may well turn out that we will indeed have to choose. Which do we want, improved quality of life or improved job performance?

Why would anybody suppose we can't have both? Because we have already seen many instances in which improving job performance does diminish quality of life. Consider first a relatively trivial case, and then an ominous one. Thanks to global positioning systems (GPS), it is no

longer possible to have the thrill of navigating your little boat across the ocean, relying on sextant and chronometer. You would be foolish to the point of criminal negligence to leave port on such a voyage without availing yourself of the best practical technology, and that technology takes the task of navigation out of your hands, routinizes it to the point where “job performance” is well nigh perfect, but job satisfaction is well nigh invisible. It's too easy a task to care about, so there is one less adventure-opportunity in the modern world. You can “rough it,” locking your GPS in a box to be opened only in case of emergency, but that's an exercise in make-believe, like camping out in a theme park. The risks are all packaged.

Much the same future looms for the practice of medicine: as diagnostic technologies get better and better, the satisfactions will correspondingly evaporate. “You” caught your patient's cancer early enough to treat it successfully, but hey, all you did was order a few obligatory tests, and one came back positive. Anybody could have done it. More to the point, anybody would have been obliged to do it. A miracle of modern medicine has happened, but the “art” has been distributed throughout a huge network of technology, leaving only *relatively* routine activities for the human participants. Where there are few opportunities for heroism, for genuine, risky adventure, the quality of life is diminished. But from the patients' point of view, this is just as it should be: may all *my* medical care be as routine and risk-free — and, yes, boring — as possible!

This trend towards improved job performance with decreased grounds for satisfaction shows every sign of growing indefinitely with or without implantable brain chips. Imagine a brain chip specialized for anesthesiologists; all the outputs from all the monitoring equipment that now confront the doctor in the operating room are collected in a radio device that transmits them to the chip, for handy distribution to various appropriate cortical areas. Bad idea. Instead, just slap some earphones on the anesthesiologist and code the information about vital signs into an appropriately modulated

ensemble of sounds that form a natural system that can be readily understood and internalized, and you've accomplished a superb impedance match; your anesthesiologist is optimally ‘wired’ without any wires in the brain. (This is not a fantasy; just such a device has been patented and will soon be in production.)

Implantation is an extreme measure that probably will never be warranted except in very special cases, where people have lost the function of some part of their nervous system. But even here, it is still not clear that implanted interfaces will be more effective than external, wearable interfaces that avail themselves of some underutilized part of the extraordinary bandwidth of the total human sensory surface. But this may change, so let's consider the range of outcomes that might confront us if implantation becomes a highly desirable course of action.

Whenever a new technology is created, it has the potential to create a new disadvantaged group: those who for whatever reason cannot avail themselves of it. When the highly visual desktop and mouse interface revolutionized human-computer interactions, a large corps of blind programmers lost their livelihoods. They could keep up with sighted programmers as long as everybody was using old-fashioned line editors which moved text around by multiple-keystroke commands, but highlight-and-drag was beyond the capacity of Braille displays to convey to their fingertips. Some activists went so far as to urge outlawing the desktop and mouse, on the grounds that it was a violation of the Americans with Disabilities Act. It is certainly *possible* (however unlikely) that some equally enhancing brain chip will be developed that can only be implanted in brains that have some currently negligible feature — a deeper-than-average central sulcus, for instance. Then we'll have created a new ethical problem: what to do about the 50 percent of the population that are ineligible for the new boon.

There is no way to avoid such problems. Any technology worth developing enhances some valued ability, and hence is almost certain to magnify some differences in ability. In some arenas of human

competitive action we particularly prize equalization of ability, and in some we don't. If some violinist wants to take drugs to enhance her performance, or insists on wearing some hearing-enhancing device to improve her pitch, ensuring herself a position in the orchestra, that's her business; she may ruin her health in the quest for artistic glory (and the increasing use of beta-blockers by musicians raises some troubling issues), but we currently have no ethic that insists that she give less radically dedicated musicians a "sporting chance" to compete with her.

The use of technology in enhancing the abilities of athletes, in contrast, is a fascinating battleground for our intuitions of fairness. High-altitude training camps are OK, but achieving some of the same physiological effects by stockpiling the athlete's own blood and retransfusing it is beyond the pale — according to some people. The coach may call instructions from the sidelines (and a hearing-impaired athlete can wear a hearing aid to take advantage of this advice) but a radio-receiver tuned to the coach's transmitter is out — in some sports, but not in others.

What resources may a competitor bring to an examination or quiz? A calculator? A laptop? A cellular phone? Once again, the issue of implantation doesn't seem to me to raise *new* problems. If you can "phone a friend" to get the answer, it doesn't much matter whether your cell phone autodialers from its home in your cingulate gyrus.

Very few people today know how to calculate square roots by hand, and why should they? Why memorize the list of state capitals or Tudor kings or amino acids when these can be retrieved in a few seconds from a website (or an old-fashioned multi-volume encyclopedia)? We tend to prize the skills we had to learn in school, even as they become utterly obsolete, and we tend to import the sports ethic into other arenas even when it is of dubious relevance. These heartfelt convictions may be wise or foolish, but we can't just jettison them all. We do need to agree to live by some relatively stable and mutually acknowledged set of rules, and as technology changes the background conditions, we have to revise these understandings. Equality of opportunity is an elusive goal worth striving for, however the sands may shift beneath our feet as we do so.

What, finally, of the "sinister invasions of liberty and privacy" that McGee and Maguire warn about? They are already upon us, without the need for implants. A bracelet locked on a child's or convict's ankle will do as well as an implanted chip. For that matter, a credit card or a cell phone with GPS will do as well. The prospect of implantable brain chips may *dramatize* the issues for us, but we shouldn't make the mistake of thinking that the unlikely prospects of developing such chips shows we may safely postpone decisions about them.

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McGee and Maguire's reply

Professor Dennett's intriguing response to our paper on "Implantable brain chips: ethical and policy issues," claims that brain chips add nothing new to the ethical concerns raised by technology in general, and that "there is no way to avoid such problems." Essentially, he seems to assume that the endeavor of reflecting upon and controlling technologies is futile. Our paper did not claim that brain chips will raise uniquely new ethical issues; rather our point is that there are ethical problems inherent in the proper human uses of technologies, that brain chips are a likely future technology, and that it is both possible and necessary to formulate policies and regulations which will mitigate their effects.

There are differences between harnessing the power of fire and harnessing that of nuclear energy, between the use of carrier pigeons and the direct transmission of thoughts via wireless brain waves. That these differences are ones of degree rather than of kind, does not imply that they are insignificant. A "tool" such as implantable brain chips collapses the traditional separation between the tool and the subject using the tool, and necessitates mechanisms to ensure that it is a tool that one can choose not to use. Concerns about autonomy, privacy and the just allocation of benefits are not ethical issues that will suddenly become real with the advent of brain chips; rather the technology will put new forms of stress on privacy, autonomy and justice,

and the task of applied ethics is to look for practical ethical responses to such posited problems. It is more than probable that brain chips will be used since they will very significantly reduce the power required and provide for a highly efficient system. To adopt a fatalistic attitude towards this development is irresponsible, and will leave the decision making in the hands of technocrats, corporations and governments. □

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should reassure those who worry about thoughtless disposition of embryos. RESOLVE, the support group for people facing infertility, has come out in support of federally funded stem cell research.

In sum, if it becomes possible to use public money for stem cell research, the NIH rules that would apply are, if anything, overprotective of potential donors. In the private sphere, the standard protections for informed consent that pertain to any research setting are sufficient to ensure that couples are making the decision whether or not to donate their spare embryos in ways that are consonant with their values. □

¹ Kaji EH, Leiden JM. Gene and stem cell therapies. *JAMA* 2001;285:545–50.

² Southwick R. 95 Lawmakers ask Bush to allow federal aid for stem-cell studies. *Chronicle of Higher Education* March 30, 2001.

³ Southwick R. College presidents back stem-cell research. *Chronicle of Higher Education* April 6, 2001.

⁴ American Association for the Advancement of Science, Institute for Civil Society. *Stem Cell Research and Applications: Monitoring the Frontiers of Biomedical Research*. Washington, DC:AAAS, 1999.

⁵ *Ethical Issues in Human Stem Cell Research, Executive Summary*. Rockville, MD: National Bioethics Advisory Commission, 1999. <www.bioethics.gov>.

⁶ *Draft National Institutes of Health Guidelines for Research Involving Human Pluripotent Stem Cells*. Rockville, MD: National Institutes of Health, 1999. <www.nih.gov/news/stemcell/draftguidelines.htm>.

I would argue that the truth lies between these two views. Clearly, it is a mistake to think that a sense of moral repugnance or anxiety is sufficient to end debate. However, it is not irrelevant to the debate either. Analysis of these moral concerns and using them as a way to frame issues may be useful in a way that a simple risk-benefit analysis will miss. For example, an important source of concern is not merely risk, but such questions as, who is exposed to the risk? Who has the power to make decisions about that risk? Is the scientific community accountable to the public? These and other questions must be addressed as central to debates over genetically modified organisms. The sources of moral concern must be explored and addressed if we are to move forward with a technology that offers both promise and pitfall. □

¹ Cho MK, Magnus D, Caplan AL, McGee D. Policy forum: genetics. Ethical considerations in synthesizing a minimal genome. *Science* 1999;286:2087-90.

² Pollan M. Playing God. *The NY Times Magazine*, Oct. 25, 1998.

³ Gaskell G, Bauer MW, Durant J, Allum NC. Worlds apart? The reception of genetically modified foods in Europe and the U.S. *Science* 1999;285:384-7.

⁴ Kass LR, Wilson JQ. *The Ethics of Human Cloning*. Washington, DC:AEI Press, 1998.

⁵ Pence GE. *Who's Afraid of Human Cloning?* Lanham, MD:Rowman and Littlefield, 1998.

Ethicist (Continued from Page 3)

sufficient time to seek transfer of the patient or court intervention — which they chose not to do.

All treatments and monitors were withdrawn and JB died peacefully in the presence of his family. □

¹ Schneiderman LJ, Jecker NS. *Wrong Medicine: Doctors, Patients and Futile Treatment*. Baltimore, MD: Johns Hopkins University Press, 1995.

² Schneiderman LJ, Faber-Langendoen K, Jecker NS. Beyond futility to an ethic of care. *Am J Med* 1994;96:110-4.

³ Schneiderman LJ. The futility debate: effective versus beneficial intervention. *JAGS* 1994;42:883-6.

⁴ Schneiderman LJ, Capron AM. How can hospital futility policies contribute to establishing standards of practice? *Cambridge Q Healthcare Ethics* 2000;9:524-31.

⁵ Johnson SH, Gibbons VP, Goldner JA, Wiener RL, Eaton D. Legal and institutional policy responses to medical futility. *AHA Journal of Health Law* 1997;30:21-47.

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The Lahey Clinic Medical Ethics Newsletter encourages reader participation. We welcome comments for our "Dialogue" column and invite submission of ethical dilemmas for "Ask the ethicist." Send correspondence and requests for complimentary subscriptions to David Steinberg, MD.

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