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UNETHICAL CONTEXTS FOR ETHICAL QUESTIONS[1]

Like most biologists, I have suffered from occasional bouts of physics envy. One of the high points of my years at college occurred midway through a course in general physics—the only physics course I've ever taken after high school. We were studying sound, and somehow, probably using neurons that have long since died, I managed to derive without help the equation for the Doppler Effect. Suddenly a window opened up somewhere in my mind, and peering through I caught a glimpse of the glorious, crystalline world of theoretical physics, inviting me in. But before I could crawl through it, the window slammed shut, smashing a few more neurons in the process. Since then, I have had to content myself with the study of biology, not even molecular biology and biochemistry (apart from a few clumsy forays in medical school and graduate school), but physiology, ecology, behavior, natural history, and—I hesitate to admit it—a decades-long interest in the relationship between society, technology, and environment.

In the beginning of my academic career, the physics envy was stronger, and on the blackest days I found myself doubting whether Charles Darwin was as bright as Isaac Newton. The theories of physics appeared more comprehensive, more general, more fundamental, more mathematical, and more predictive than most of those of biology or any other field inside or outside science. However, as I got older and learned a little more about how the world works, I began to realize that physics envy was a waste of emotional energy. Physics actually deals with some of the simplest systems the human mind can comprehend: one or two sub-atomic particles, for example, or the statistical uniformity of the molecules of an ideal gas. The rest of us, meanwhile, cope with generality-defying, prediction-defying complexity, especially as we stray farther and farther from physics, even as far afield as ethics. We all long for simplicity, but we are bogged down in a sea of interacting variables. It doesn't seem fair.

Looking a little more closely, however, I began to see that physics is not really simple. The dynamic chaos of earth, sky, moon, planets, and stars that Newton saw around him did not resolve itself into laws of motion, gravitation, and cooling. He had to find the simplicities, the basic patterns in the realm of creation he chose to study; he had to find the right explanatory contexts in which his genius could operate effectively. Contemporary physicists are faced with the same problem, and it has become clear that the models for and solutions to "basic" questions do not help answer those of a less basic nature; other contexts are required. The models of elementary particle physics are of little use in helping physicists understand the less

[1] A modified version of this essay was published under the title, "The Cow Tipping Point" in *Harper's Magazine* 305 (October 2002): 13-20.

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fundamental solid state or many-body physics (although the converse is not necessarily true). As the distinguished physicist P.W. Anderson wrote in a celebrated paper:

> The reductionist hypothesis does not by any means imply a "constructionist" one: The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe. In fact, the more the elementary particle physicists tell us about the nature of the fundamental laws, the less relevance they seem to have to the very real problems of the rest of science, much less to those of society.[2]

Darwin had the same task of finding the right context: at home and in his travels he encountered many settings of nature, many contexts, and profited from them all; but not until he reached the Galapagos Islands did he come across the context for understanding evolution. His special gift, like that of Newton, was recognizing it.

Conversely, choosing the wrong context when answering a particular question, and especially confining oneself to an overly narrow context, is very likely to lead one astray. For example, the isolated gene has been a useful context for answering some of biology's most important questions, but for other questions, as the Harvard biologist Richard Lewontin has pointed out, the gene alone, considered apart from the intracellular, extracellular, and external environments in which it functions, has proven an unreliable context for answering questions such as, What is the cause of schizophrenia?[3] 40 years ago, another Harvard biologist, Ernst Mayr, made similar observations about the limitations of isolated single genes as a context. In a chapter entitled "The Unity of the Genotype" in his book *Animal Species and Evolution*, he made compelling arguments to show that the effect of genes was strongly modified by other genes and by the internal and external environments, and varied from individual to individual.[4] This was based on powerful research findings in studies going as far back as 1937, and earlier. Unfortunately, many of today's genetic engineers give no sign that they have heard the message of Lewontin and Mayr.[5]

The matter of context also applies to ethical questions. How can we decide what is right and what is wrong, what to do or not to do in these times, which are probably the most complex in human history because we have taken on the management of so many more things in the world than ever before? In my book, *Swimming Lessons: Keeping Afloat in the Age of Technology*, I discuss the words of the 18th century Ukrainian philosopher, Gregory Skovoroda, who said: “We must be grateful to God that he created the world in such a way that everything simple is true, and everything complicated is untrue.”[6] I wish I could believe this, but I am afraid that I do not. Nevertheless, there are ways to cut through the complexity, to approach the underlying simplicities, the basic truths that we must see if we are to survive as individuals and as a society in this Age of Management. This is what modern giants such as Lewis Mumford, George Orwell, Heinrich Böll, Jane Jacobs, Mary Midgley,

[2] Anderson.
[3] Lewontin.
[4] Mayr.
[5] Cf. Commoner.
[6] Ehrenfeld, *Swimming Lessons*.

Wendell Berry, and Vaclav Havel have done, each finding the right contexts—usually very spacious ones—in which to set their questions. But to find the right contexts, we must survey as many of them as possible. If we restrict ourselves to a narrow context, complexity is very likely to hide the basic truths.

This is not a problem for everybody, however. There are those who, for one reason or another and usually for short-term personal advantage, do not care to approach the truth too closely. For them, complexity is a godsend. Like a squid escaping its pursuers in a cloud of ink, they can use complexity to obscure their movements, to hide the significance of what they are doing. By selecting the narrowest from the many available contexts in which to portray and evaluate their own actions, and by cloaking these actions in a haze of technological intricacy, people can get away with behavior that society would not countenance if it were thinking clearly. I will give some concrete examples.

Recombinant bovine growth hormone, rBGH for short, sometimes called recombinant bovine somatotropin, or rBST, is a growth hormone for cattle produced by taking the growth hormone gene from cows, modifying it very slightly, and inserting it into bacteria, using techniques of genetic engineering.[7] The altered *E. coli* bacteria can be grown in vats, producing large quantities of rBGH, vastly more than could be obtained economically by extracting the unmodified growth hormone directly from cows. This rBGH, like its parent gene, is very slightly different from the natural product, having a substitution of just one amino acid for another at the end of the large molecule. In the United States, rBGH is marketed by Monsanto under the name of Posilac. When injected into lactating cows, it increases overall milk yields by approximately 10-15%, although greater increases are occasionally observed.[8]

This is a dramatic kind of biotechnology, albeit dependent on a relatively rare phenomenon: a single gene coding for a product that is directly or indirectly commercially valuable. Not surprisingly, as is the case with all new technologies that cause radical changes in production systems, economics, and cultural systems, the marketing of rBGH has engendered a great deal of controversy.

From the beginning, the controversy swirled around two questions: Is the milk from cows injected with rBGH different from milk from untreated cows; and if so, is it harmful to the humans who drink it? Second: Does the injection of rBGH into lactating cows harm the animals in any way? Monsanto has not been able to provide an unequivocal no to either of these questions, and this may be part of the reason why Posilac has, by many accounts, not proven to be a cash cow for the company. Yet I imagine (I cannot prove it) that Monsanto would prefer to keep the rBGH controversy confined to these issues, because the context of the questions is pleasingly narrow—in other words, most of the ethical concerns generated by the use of rBGH do not come up at all. Moreover, the two questions, because of their nature, can be drawn into a mire of complex and often contradictory technical and scientific details that make clear judgments difficult to achieve. This confusion works well for Monsanto, because the company wants sales, not judgments.

[7] Hansen.
[8] Coghlan.

Before widening the scope of the inquiry, I want to dispose of the two questions. Is rBGH milk different from other milk? Yes and No. According to a paper published by Samuel Epstein in the *International Journal of Health Services* in 1996,[9] and earlier reports summarized by T. B. Mepham in the *Journal of the Royal Society of Medicine* in 1992,[10] rBGH milk contains elevated levels of Insulin-like Growth Factor-1 (IGF-1), a suspected cause of human breast and gastrointestinal cancers. Supporters of rBGH are quick to point out that IGF-1 also occurs in milk from untreated cows; and that its carcinogenic effect is not conclusively proven. Opponents respond that there is at least a three- or four-fold increase of IGF-1 in rBGH milk, and that more of it may be in an unbound, free form, which might be biologically more active. It also should be noted that rBGH itself is present in the milk of treated cows, perhaps in elevated levels over the natural hormone, and it is possible that this unnatural protein could cause allergic reactions or, after partial digestion in the human gut, mimic the metabolic effects of human growth hormone. Lots of "mights" and "maybes," credible suspicion but no proof, no smoking gun. The ink is swirling in clouds. Let's look at the second question: Does rBGH injection harm cows?

At first glance, rBGH does not come off so well. To avoid charges of anti-rBGH bias, I will take my information from the package insert for Posilac ("sterile sometribove zinc suspension"), copyright by Monsanto in 1993. According to the manufacturer's label, use of Posilac causes "feed intake increases over several weeks" after starting injections. No surprise there; the laws of thermodynamics hold for cows. The animals are producing more milk, so they must eat more food—I will come back to this later. Use of Posilac also "may result in reduced pregnancy rates... increases in cystic ovaries and disorders of the uterus...small decreases in gestation length and birth weight of calves... reductions in hemoglobin and hematocrit values... periods of increased body temperature unrelated to illness... indigestion, bloat, and diarrhea... increased numbers of enlarged hocks and lesions [of the knee]... [and] disorders of the foot region." But the biggest health problem for rBGH-injected cows is "an increased risk for clinical mastitis (visibly abnormal milk).... In addition, the risk of subclinical mastitis (milk not visibly abnormal) is increased." "Visibly abnormal milk" means pus in the milk.

The label's recommendations for how to cope with this constellation of problems seem quite sensible. I will condense and paraphrase them: Be sure you are ready to deal with increased veterinary problems, presumably by keeping more veterinarians on staff or on call; be ready to differentiate between fevers caused by rBGH and fevers caused by disease; and for cows running a fever, control heat stress "during periods of high environmental temperature," I suppose by means of air conditioning; and, implement a "comprehensive and ongoing herd reproductive health program," whatever that means.

It is worth noting that none of the ailments listed as being associated with rBGH injection are unique to this treatment; cows can get mastitis, bloat, and sore knees even if they are raised under strict conditions of organic husbandry. And Monsanto

[9] Epstein.
[10] Mepham.

has pointed out that the increase in mastitis may be a result of increased milk production itself, thus only indirectly caused by rBGH injection. The clouds of ink thicken. Again, we are left with legitimate worries that have not been properly addressed by the Food and Drug Administration (FDA), but without an absolutely clear-cut mandate to condemn the technology.

In a situation of this kind, what usually happens is a continuation of the status quo. The results of peer-reviewed research produced by independent scientists are contradicted by the results of peer-reviewed research sponsored by the company. Each study, regardless of authorship, is run in a different way under different conditions, making comparisons problematic. Some necessary analyses, such as distinguishing between natural BGH and rBGH in milk, prove difficult or impossible. The federal regulators, some of whom were formerly executives in the regulated industry, feel justified in keeping the product on the market. And the worries persist.

This is the time to widen the context of the inquiry, to reject efforts to keep questions confined to a narrow space where visibility can always be obscured by more convenient ink. I propose to widen the context gradually so that we always know the vantage point from which we are viewing the bioethical landscape. Eventually, the basic truths of the matter should be fairly clear, if they aren't already; and the conclusions we ought to reach about the technology will be obvious.

The first small step to take is to see what happens when we merge questions one and two. The most solid finding from the inquiry into the effects of rBGH on the health of cows is that treated cows get significantly more mastitis than untreated ones. This is a finding admitted by Monsanto and confirmed by the FDA.[11] Mastitis in cows, like breast infections in humans, is usually treated with antibiotics, and these antibiotics may well find their way into the milk. In an ideal world, milk containing antibiotics is kept off the market. This is not an ideal world. Government agencies test milk for only a small number of antibiotics, and they do not test every batch; there are many antibiotics that can slip through into supermarket milk. Careless or unscrupulous farmers may sell milk containing antibiotics, and some farmers may be willing to deliberately treat their cows with antibiotics that they know are not going to be screened in government tests. When antibiotics get into the milk, antibiotic resistance can be transferred from the bacteria normally in the milk to the bacteria that normally live in the intestinal tract of humans, and this resistance can be transferred again during illness to the bacteria causing the disease.[12] The result is that when antibiotics are given to sick people, they do not work.

An analogous case concerns the refusal, early in 2001, of the Bayer Corporation to heed the request of the Centers for Disease Control and Prevention and the Food and Drug Administration's Center for Veterinary Medicine to stop selling their fluoroquinolone antibiotics for routine use as growth promoters in the diets of factory-farmed chickens, turkeys, and pigs. There is mounting evidence that feeding fluoroquinolones to poultry is causing widespread bacterial antibiotic resistance that

[11] Coghlan.
[12] Ferber, “Superbugs on the hoof?”

can make these drugs useless for treating many human infections.[13] (The most familiar of the fluoroquinolones is ciprofloxacin, sold under the brand name of Cipro™.)

Let's widen the context a little more. I mentioned earlier that rBGH injection increases the food intake of cattle; they need more calories, particularly in the form of protein. One of the best and cheapest sources of high-grade protein is the carcasses of dead farm animals, including sheep, horses, cows, and others. For at least 100 years, the rendering industry has been converting dead animals into food supplements for livestock, but the advent of high-milk-yielding cattle and, especially, rBGH-injected cattle, has greatly increased the demand for this animal protein in cow fodder. Cows have been turned into carnivores, even cannibals. In recent years, we have become aware, however, that a terrible neurological disease, worse than Alzheimer's, called spongiform encephalopathy, is transmitted from individual to individual and even from species to species by eating brain, nerve, and other tissue from infected animals. In cattle, we call this mad cow disease; in deer and elk chronic wasting disease; in humans it is Creutzfeldt-Jakob disease; and there is little doubt that it has been spread in England and the Continent by the practice of feeding rendered, processed carcasses of other ruminants to cattle.[14] Here, then, is another legitimate and serious worry caused by the use of rBGH: will it increase the incidence of spongiform encephalopathy/mad cow disease/Creutzfeldt-Jakob disease in the United States, where this constellation of diseases already exists?

As we move farther and farther from the original narrow context, we gradually leave the realm of science and medicine and we enter the territory of ethics, economics, and social well-being. Our next consideration in this widening inquiry takes us to the welfare of cattle. Even if we ignore the ethical implications of increased disease caused by rBGH, there are other important questions to be considered. Do we have the right to treat cows as if they were mere machines for producing milk, with all the suffering and lack of respect that this implies? Do we have the right to burn them out, to shorten their useful and productive lives, which is what rBGH appears to do? According to the farmer and agricultural writer Gene Logsdon, dairy farmers used to be able to keep their cows on the milking line for twelve to fifteen years; now, with many cows being treated with rBGH, they frequently last only two or three years.[15] Accordingly, the price of replacement heifers has risen sharply, reflecting the increased demand.

Now we can widen the context again and look at the welfare and rights of dairy farmers, and, beyond that, at the welfare of the communities and larger society in which they live. Matthew Shulman, owner of a small farm in Lansing, New York, and former director of information for the New York State Grange and executive secretary of the New York State Forage and Grasslands Council, was one of the first to write on this subject.[16] He questioned the claim of proponents of rBGH that this technology is farm-neutral, that if used properly it will work as well on small farms

[13] Falkow and Kennedy, 1390.
[14] Pattison.
[15] Logsdon, personal communication.
[16] Shulman.

as on large ones. He was concerned with the prohibitive cost of high-tech feed management systems and high-protein rations, which would price rBGH right out of the market for small farmers. He also noted that the hormone was marketed primarily to large farms, anyway. Shulman's argument would have been even stronger if he had known more about the increased veterinary, air conditioning, and cow replacement costs associated with the use of rbGH. All of these costs can only be borne by large farming operations, which typically carry much higher levels of debt than small farms.

Four years later, Charles Geisler and Thomas Lyson, professors of rural sociology at Cornell, confirmed Shulman's fears in an article on the social and environmental costs of dairy farm industrialization. As Geisler and Lyson pointed out, large dairy farms have: lower technological diversity, a higher rate of accidents, worse environmental impacts, increased dependence on specialized wage labor with lower system resilience (manifested as an increased likelihood of strikes), decreased personal knowledge of individual animals, and, finally, greater centralized control and more non-resident owners, with a consequent breakdown in "economic vitality and social cohesion in rural communities."[17] A big part of the problem, they wrote, is debt; farm debt as a percentage of a farm's value increases dramatically as the size of its dairy herd increases. And as the debt-to-asset ratio increases, partly to pay for the supplementary, expensive veterinary care, climate control for feverish cows, and high-priced feed supplements that go along with the use of rBGH, control of dairy farming shifts away from the farmer and the farm community to distant banks. Then, Geisler and Lyson state, "as debt continues to rise, the dairy industry will be increasingly sensitive to non-local production factors, such as... interest costs."[18]

Once the small dairy farms are gone, the industrialized farms that remain will become completely dependent on the new milk production technologies because they cannot produce milk any other way. This will lead to the same kind of corporate vertical integration that has placed a few oil, chemical, and pharmaceutical companies in control of much of the world's agricultural seed production, resulting in the rapid, irreversible loss of thousands of agricultural food varieties of great and irreplaceable value, and putting the world's food supply in jeopardy.[19]

There is one more context in which I want to evaluate rBGH. In the eastern states from North Carolina to Massachusetts, and beyond, small dairy farms have long given a particular look and character to the rural countryside. Typically, such a farm comprises 80-95% upland pasture and 5-20% wet grazing areas: stream corridors, marshes, and bogs. The whole is divided into small fields through which the cattle are rotated. It has become clear in recent years that the cows on these small dairy farms accomplish much more than just milk production. They have serendipitously replaced, in the wetland areas, other large eastern grazing mammals, the mastodons, elk, and bison, which have been progressively eliminated by waves of human settlers, starting eleven or twelve thousand years ago. Like these former native grazers, cows eat and therefore control the invasive, and these days often

[17] Geisler and Lyson.
[18] Ibid.
[19] Fowler and Mooney.

exotic, species that are modifying and eliminating wetland species and plant communities. They eat red maples and alders, *Phragmites*, reed canary grass, purple loosestrife, and similar invasives that otherwise choke out wetland vegetation all over these eastern states. Thus, if you want to find the tiny bog turtle (*Clemmys muhlenbergii*), the fen buck moth (*Hemileuca sp. 2*), the showy lady slipper orchid (*Cyripedium reginae*), or the spreading globeflower (*Trollius l. laxus*)—all of them rare and endangered—you will have to go to a small dairy farm, or land that was a small dairy farm until recently; you probably will not find them anywhere else.[20] So here is yet another effect of rBGH: the big, industrialized dairy farms that rBGH promotes, with cows being fed high-protein food supplements in temperature-controlled buildings, do not serve the smaller farms' unexpected function of maintaining the flora and fauna of wetlands.

Why has the United States, which in 1986 and 1987 paid 14,000 dairy farmers $1.8 billion to slaughter 1.55 million dairy cows to reduce the milk glut, and which between 1987 and 1989 paid between $600 million and $1.3 billion a year to purchase surplus milk, been pushing rBGH so hard? And how has the government gotten away with it? The first question is easy to answer: Monsanto and similar companies have been major contributors to both the Republican and Democratic parties. The second question is easy to answer, too. The government has gotten away with it because it has confined the ethical debate to the narrowest possible context, where the waters were muddy and the larger issues lay hidden.

Even with this context restriction, the case for rBGH is so weak that only the most skillful political damage control has kept it on the market in the U.S. Canada and the European Union have both banned rBGH, on the significant but narrow grounds of animal health. And in 1999, the Codex Alimentarius, the food safety standard organization of the Food and Agricultural Organization and the World Health Organization of the United Nations, refused to certify rBGH as safe. It effectively tabled the rBGH issue as a way of saving face for the U.S., which would have lost a formal vote.

In summary, we must look at the entire picture of the effects of rBGH: this is not only IGF-1 in the milk and animal health, but antibiotic resistance, spongiform encephalopathy, animal welfare, the welfare of farmers and farm communities, the well-being of agriculture, and the maintenance of whole ecosystems. Is it legitimate to widen the context so broadly in evaluating a new technology? Yes; it is more than legitimate. It is practically and ethically essential if the the truth is to emerge, for the message produced by these overlapping and widened contexts is really quite simple to understand: rBGH is a very bad technology indeed.

Having examined the rBGH controversy in some detail, it might be instructive to look more briefly at a few other examples that show the value of contextual widening. Genetically modified food (GM food) is a category somewhat different from that of rBGH milk. "GM food" is food made from crops that have received genes via genetic transfer from other organisms, even distantly related ones. Salmon, for example, can be engineered to contain human genes, and corn now contains bacterial genes. Most of the GM food on the market is from crops either

[20] Lee and Norden; Tesauro.

engineered to produce an insecticidal bacterial polypeptide commonly known as the Bt toxin, or to produce enzymes that inactivate the seed company's brand of weed killer, as in the case of rapeseed and soybeans.[21] In the former instance, crops producing their own Bt toxin are marketed to farmers as requiring less external insecticide application. In the latter case, conversely, farmers are told that they can liberally apply the company's herbicide without fear of damaging their crops.

Again, the proponents of GM foods have tried to keep the evaluative context as narrow as possible, asking: Do these foods contain harmful substances? And again, apart from a few obvious mistakes involving genes from highly allergenic foods such as brazil nuts transferred to soybeans, and genetically engineered gene products not approved for human consumption introduced into corn, the question of toxicity does not yield a clear answer; there is a lot of scientific-technical ink in the water. The anti-GM group notes that these foods contain alien polypeptides and proteins, which might cause illness in susceptible individuals. The pro-GM voices respond that plants have been producing toxic chemicals to kill insects and competing plants for millions of years: witness the insecticide nicotine in tobacco, and the ghastly compound produced by tobacco's cousin, the white potato, if you expose the growing tubers to sunlight. True, reply the antis, but we have had millions of years to evolve biological and cultural responses to natural toxins in the food we eat. Fine, retort the pros, but what about this: nature was moving genes between species for countless millennia before agriculture began; and, further, conventional plant and animal breeding, which everyone accepts, also shuffles genes from one variety to another—even from one species to another. Yes, respond the antis, but not between spiders and goats, or people and pigs. And so it goes. It is time to widen the context.

For GM foods, much more than rBGH, there has already been a little context widening. Newspapers have documented the probably deleterious effect of Bt-containing crops on monarch and other butterflies, and some public comment has emerged about the general damage to pollinating insects from continuous exposure to the insecticide produced by GM crops day after day, month after month, over hundreds of thousands or millions of acres. Public mention has even been made of the fact that GM crops can move herbicide resistance genes into the weeds and cause insect pests to evolve resistance to the Bt toxin.[22] A less publicized facet of the Bt story is that the loss of effectiveness of this natural insecticide could put many organic farmers out of business, a side effect that might not displease the chemical companies that own the seed companies that make the GM crops.

When we widen the context, however, to include the well-being of the farmers using GM crops, public attention drops off. In the late 1990s there was some brief publicity given to cotton farmers in the south, who brought suit against the manufacturer of GM crops because the crops, they claimed, did not work as advertised, and because the expensive, one-time technology use agreements they were required to purchase with the GM seed were only good for one planting. But until recently I have seen comparatively little public mention of the case of the

[21] Teitel and Wilson; Ho.
[22] Holmes, 7; Robert and Baumann; Ferber, "New corn plant draws fire," 1390.

Canadian farmer, Percy Schmeiser, whose rapeseed crop was discovered by Monsanto's "gene police" to contain patented genes for herbicide resistance from Monsanto's GM rapeseed, which Schmeiser had never purchased.[23] As has been repeatedly demonstrated, pollen containing industrially produced GM genes, can move considerable distances to enter both conventional crops and wild plants.[24, 25] Despite the possibility that the patented GM rapeseed genes got into Schmeiser's crop not by deliberate theft but by pollen blown from the GM rapeseed fields across the street from his farm, and despite the fact that Schmeiser claimed he was not using the Monsanto herbicide that would have let him benefit from those patented genes, a Canadian lower court judge found Schmeiser guilty and ordered him to pay Monsanto heavy damages.[26] Schmeiser's case is not unique. Other farmers in the United States and Canada have been assessed damages by Monsanto for alleged infringement of gene patents. The implications are chilling for farmers everywhere who don't want to buy genetically modified crop seeds. Why isn't this context receiving careful scrutiny?

Clearly, beyond the narrow question of whether GM food will make you sick, there are enormous problems with the technology—and we are not looking at those questions. I will briefly mention three more. First, there seems little doubt that the introduction and widespread use of GM food crops will cause a further reduction in the number of major crop varieties in existence, a process already started by the industrialization of agriculture. This will narrow the genetic base of agriculture, which in turn will paradoxically limit the future opportunities for both genetic engineering and conventional breeding. Reduction in the number of crop varieties will also make us more vulnerable to the spread of crop pathogens by terrorists, a fact well-known to the bioterrorism taskforce.

Second, and related to the first, the granting of industrial patents for genetically modified crops (including crops whose genes have been sequenced but hardly modified at all) allows a handful of corporations to own and control much of the world's food. This development seems at least as worthy of discussion as the current activities of terrorists. I am convinced that profitability has little to do with the corporate push to introduce GM crops. They often don't work very well: they do not necessarily increase yields, nor will they outlive the development of insecticide and herbicide resistance in insect pests and weeds. Sooner or later their sales will slump, and the industry knows it. The real reason for this technology is that it opens the door to the corporate patenting and ownership of our food crops.[27]

Third, there is one more context which is of special importance to those Jews, Muslims, Hindus, and others who observe ritual purity laws for food. Is the food

[23] Rural Advancement Foundation International.

[24] Klinger, Elam and Ellstrand; Ellstrand; Quist and Chapela.

[25] See also the debates about the paper by Quist and Chapela, which were published in *Nature* 416 (2002): 600-602; *Nature* 417 (2002): 897-8; and Mann.

[26] A court later held that Schmeiser did not have to pay damages or legal fees to Monsanto because he did not intend to "steal" the seed.

[27] Hobbelink.

acceptable if it contains gene products from unacceptable species? Most religious authorities have not begun to deal with this problem.

Therefore, for all the reasons I have mentioned, I believe it is unethical to confine the GM food issue to a discussion of direct toxicity. Yet this is exactly what has been done. For example, the medical ethicist Marc Lappé, who was chosen as a consultant for a National Research Council study of a major group of genetically engineered crops, "was asked to limit my scrutiny to scientific data and to focus solely on scientific questions of risk while eschewing political, social, or philosophical issues." Therefore, "the NRC asked for a review that had a foreordained answer: Insufficient evidence exists on which to base health concerns from GMOs."[28]

Not surprisingly, problems of context extend beyond the realm of agriculture and genetically modified foods. My next example of a context problem in bioethics is that of human reproductive (and possibly therapeutic) cloning.[29] I will give it short shrift, however, because I agree with M.I.T.'s Rudolf Jaenisch and the Roslin Institute's Ian Wilmut, cloner of Dolly, that human cloning is not going to work in an acceptable way for the forseeable future.[30] Also, if reproductive cloning can ever be made safe and reliable, a very big *if*, the recipients of cloned children (those who are not just growing them for spare parts) will be terribly disappointed, because cloning—for biological, cultural, and environmental reasons—does not produce xerographic copies.

"That's not me!" I can imagine an angry, Fortune 500 CEO shouting, as he bails his shiftless, stupid, cloned, adolescent son out of jail. "He doesn't even look like me!" Enter the lawyers.

But questions of feasibility do not stop us from talking about human cloning, so I will mention just one newspaper article entitled "Two Cheers For Human Cloning," by Sheryl Gay Stolberg.[31] It is a good article, examining many of the moral and some of the technical arguments pro and con. It states them very clearly, repeating the points of view of scientists, ethicists, potential parents of cloned children, Congress, and even the biotechnology industry (which appears to oppose human cloning for the strategic reason of preserving its related research). But nowhere in the article is there any discussion of the context outside that particular ethical box: namely, what will happen, ethically and practically, should human cloning become commercially available? What will be the consequences of granting such immense power over human reproduction to a few corporations and non-profit organizations?

My last example of the value and ethical necessity of context widening comes not from biotechnology but from the practice of species conservation. A 300-square-mile chunk of the Edwards Plateau of central Texas is occupied by the U.S. military base called Fort Hood. On that base, as elsewhere on the plateau, live two endangered species of birds: the black-capped vireo and the golden-cheeked warbler,

[28] Lappé, "A perspective on anti-biotechnology convictions."

[29] Human reproductive cloning, which aims to produce a human person, should be distinguished from therapeutic cloning, in which a primary goal is to glean useable stem cells and tissues for research.

[30] Jaenisch and Wilmut.

[31] Stolberg.

each of whose total remaining populations number in the hundreds or low thousands of individuals. Although protected on the base, these two species were in decline until recently because of nest parasitism by the brown cowbird. The cowbirds, which are anything but endangered, and which are also native residents of the plateau, always lay their eggs in the nests of other species of birds. The cowbird chicks hatch first and hog most of the food brought by their hapless foster parents. Few vireo and warbler chicks from cowbird-infested nests survive.

For the past few years, wildlife managers at Fort Hood, in cooperation with The Nature Conservancy, have been trapping cowbirds in gigantic cages baited with grain, then killing the adult females. Predictably, vireo and warbler populations have increased on the base in response. So far, the minimal ethical debates about this kind of conservation technique have centered entirely on the rights of warblers and vireos, the rights of cowbirds, and the rights of people opposed to the killing of animals. You can imagine the ethical quagmire here. There are no simple answers.

So let us widen the context with a question: Why are cowbirds threatening vireos and warblers now, when before the past century they coexisted for countless millennia? The answer is ecological. Cowbirds feed in the open grasslands; vireos and warblers nest in adjacent brushy shrublands. The cowbirds parasitize nests built near edge areas where grassland and shrubland meet, not in the interior parts of the shrublands. Uncontrolled human land use on the base, particularly conversion of some of the hilly shrublands to grasslands for grazing by cattle, and—more importantly—unplanned, minimally regulated suburban sprawl off-base around the cities of Austin, San Antonio, and Waco, have fragmented and dissected the shrubland to the point where it is mostly edge habitat now. So the cowbird is not the real culprit; it is merely the last straw. Nevertheless, it is far more convenient and politically expedient to blame cowbirds rather than limit the cattle grazing on the base or make an effort to introduce responsible zoning and land management around the cities, while phasing out the cowbird extermination program.[32]

With so many ethical stalemates occurring in agricultural and reproductive biotechnology, and even in conservation, why do we fail to widen the context when we debate these critical issues affecting society? It is not just because we are being kept to a narrow, controllable venue of debate by vested interests, although that is usually the case. Nor is it just that much of the public, dumbed and numbed by television and advertising, is incapable of digesting anything more complicated than a sound bite. I think the deeper problem is that more than 200 years of potent scientific discoveries and technological inventions—from the steam engine to the laser scalpel—have taught us to believe that science and technology, the fruits of our own reason, constitute the highest power we need consult in our daily lives. In our euphoria we forget two things. First, technology is unable, both in theory and in practice, to resolve all of the practical problems that it, itself, creates.[33] Second, science and the exercise of reason cannot by themselves provide the moral framework we need to judge our own inventions.

[32] Ehrenfeld, "Extinction and blame."
[33] Schwartz.

In my book, *The Arrogance of Humanism*, I said much the same thing twenty-four years ago: "Pure reason [does not] suffice to distinguish the humane and the just from the inhumane and the unjust."[34] John Ralston Saul, in *Voltaire's Bastards*, speaks of "reason's innate amorality."[35] That is, if we restrict the context of our ethical inquiries to a narrow review of scientific facts, if we respect only technical information, we may never reach the sources of wisdom best suited to guide us on a just and sustainable path.

Despite the many differences that divide us, human societies have achieved a remarkable consensus about what is right and what is wrong. In the eighteenth century, an extraordinary group of scientists, educators, reformers, and political leaders in Europe and America was able to find the basic truths in the complex affairs of national and personal life. Neil Postman describes these people in *Building a Bridge to the 18th Century*—not only Voltaire but Diderot, Paine, Franklin, Jefferson, Madison, and many others.[36] They were *philosophes*, not philosophers; they were interested in finding solutions to the practical, concrete problems of the day. All of them believed, according to Postman, that "answers to the question, What is the right thing to do? (or more precisely, What is the wrong thing to do?)" were obvious, based on a transcendental authority which all of them recognized, whether they called it God, Natural Law, Practical Reason, First Principles or Traditional Morality.[37] It was this ability to superimpose a common ethical structure on the complex problems they encountered that led all of them to conclude, as Postman notes, that "the Inquisition, slavery, debtors' prisons, torture, [and] tyranny" were wrong.

We can do the same today, as Wendell Berry counsels in *Life is a Miracle*, provided we do not expect to derive our moral law from our science. As Berry says, "Applying knowledge—scientific or otherwise—is an art."[38] I believe that the necessary practice of this art in the twenty-first century will not proceed until we refuse to limit the contexts of our inquiries. And only when this happens will ethics become more than, to quote the food policy expert, Brewster Kneen, "an enteric coating on the bitter pill being forced down the public throat."[39]

Of course there are no perfect answers to many of our ethical questions. Isaiah Berlin has reminded us that the "Great Goods can collide... human creativity may depend on a variety of mutually exclusive choices." When this happens,

> compromises can be reached.... Priorities, never final and absolute, must be established.... The concrete situation is almost everything. There is no escape; we must decide as we decide; moral risks cannot, at times, be avoided. All we can ask for is that none of the relevant factors be ignored.[40]

[34] Ehrenfeld, *The Arrogance of Humanism,* 81.
[35] Saul.
[36] Postman.
[37] Ibid.
[38] Berry.
[39] Kneen, 45-59.
[40] Berlin.

And that is all I ask for, that in our most important decisions no context be neglected.

It is up to us—as a society and as individuals—to frame our ethical questions properly. Ethicists should not do it for us; this is a process too important to leave to the professionals.[41] There is urgency for us to ask these questions of ourselves. The great contemporary British philosopher Mary Midgley has warned, "The house is on fire; we must wake up from this dream and do something about it."[42] But to do something appropriate we must make the right decisions. And these, in turn, require our taking the most inclusive view of the contexts of our activities that we can command in the time available.

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[41] McKnight.
[42] Midgley.

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