Virtue Theory and Genetically Modified Crops – Joshua Colt Gambrel

The science of biotechnology pertains to biologically based scientific advancements primarily in the fields of agriculture, food science, and medicine. Genetically modified crops (GM crops), or transgenic crops, constitute one large and growing application of biotechnology and will represent the applied focus of this paper. During the past several decades the total acreage allocated to grow genetically modified plant cultivars has significantly increased. For example, in 2006, GM crops constituted 61 percent of the corn acreage, 89 percent of the soy-bean acreage, and 83 percent of the cotton acreage in the United States.[1] In this paper I hope to provide an answer to the question, "Are we morally justified in utilizing GM crops?" I will be examining this question from the perspective of virtue theory – a unique position within moral philosophy. Throughout this process I will draw on several salient case studies to illuminate how virtue theory may directly inform our ethical deliberations related to the application of biotechnology in agriculture. After providing an argument for virtue theory and contrasting the virtue of humility with scientific hubris, we will then unpack the contingent issues surrounding GM crops in an attempt to discover whether or not the use of transgenic crops is indeed morally justified.

Why have I chosen virtue theory as the paradigmatic system from which to analyze the issues pertaining to GM crops? In our day-to-day lives we are rarely presented with black and white moral alternatives. Such a situation wouldn't pose much of a dilemma anyway. The web of life that binds us all together illuminates a world where we have many responsibilities. These responsibilities may be to our friends, our families, our social communities, our ecological communities, or the very networks that hold all these

[1] U.S. Department of Agricultural Economic Research Service. 2006. *Adoption of Genetically Engineered Crops in the US.* http://www.ers.usda.gov/Data/BiotechCrops/

together. With so many substantive moral considerations there will be situations where responsibilities to them may conflict. This is the real world in which we live. Some choices may be the right ones in some cases, but wrong in others. An effective, fitting ethical system will be applicable to our daily lives and show us how to live a moral life within the contexts we are given. Such a system will take into account the ethical ambiguities of our world-embedded existence. Virtue theory offers us a moral system that addresses these concerns. By focusing on virtues, we are working to develop certain character traits, attitudes, and dispositions that will help us lead a morally good, communally responsible life. Contra some virtue ethicists, I believe virtue ethics do have a codifiable component. How would they not and still be applicable in manifold situations by a diversity of agents? In effect, my formulation of virtue theory here posits ethical *guidelines* to shape moral behavior in our everyday, highly interconnected existences. These guidelines do offer decision making procedures for determining what a right action would be in a given context in such a way that could be applied in our lives.

We may now begin our project by examining what I mean by a virtue ethic. An ethic of virtue helps us decide what to do in a given context by conveying what a good (virtuous) person is; in essence the type of person we should become. It tries to show us what character traits we should work to cultivate and improve within ourselves. Virtue ethicists contend that if we work to develop certain virtuous dispositions in our lives, then we will be better able to make appropriate decisions that we can feel morally good about. When we are attempting to make a ruling on some ethical dilemma, and we are able to cite qualities of a particular virtue as reasons for or against a certain action, then we are on the right track to making a caring decision that we can morally justify.

Before continuing, we should pause to discuss what a virtue is, or what makes an action virtuous. Commonly, a virtue is seen as a character trait manifested in habitual action that we deem worthy to have.[2] This is a definition that posits the locus of value within the individual (specifically the individual moral agent), but for my project here I will employ a more sophisticated definition. I believe virtues are those traits that help promote individual and *collective* well-being or flourishing. The collective here is not simply human society, but includes a greater appreciation of the expanding circle of value to include non-human animals, nature, and ecosystems. These are the entities and processes that make up our morally relevant world. So, when I refer to a virtue I am referring to a moral property that meets what I will refer to as the *virtue criterion***,** namely a quality that *promotes individual human and collective human societal flourishing along with the flourishing of the non-human animals, natural processes, and ecosystem processes that are interconnected to the subjectively perceived human world*. The virtue criterion, because it is universally binding on all members of society, becomes the foundation of our moral system in a similar way to the social consensus ethic posited by philosophers such as Bernard Rollin.[3] Moral qualities that meet the virtue criterion in this case become *environmental* virtues because they take into consideration the ability to flourish of the natural world. In the words of Ronald Sandler they are "environmentally responsive virtues."[4]

A significant philosophic concept within the virtue criterion is represented by the term *flourishing*. What do I mean by flourishing? Flourishing is closely related to an

[2] James Rachels. *The Elements of Moral Philosophy*. New York: McGraw-Hill, Inc., 1986; p 163.
[3] Bernard Rollin. *Science and Ethics*. Cambridge: Cambridge Uni. Press, 2006; p. 34.
[4] Ronald Sandler. "A Theory of Environmental Virtue." *Environmental Ethics:* Vol. 28, Number 3. Denton, TX: Environmental Philosophy, Inc., 2006; p 257.

organisms' *telos*, or immanent becoming. Organisms are discovered to have a purpose or telos as they develop toward ever increasing levels of complexity or self-realization. Telos manifests itself in a process of *becoming* rather than simply a condition of *being*.[5] Living systems that are able to work toward their own self-directed ends in relation to their telos are seen as flourishing.

It would be far too convoluted and esoteric to go about trying to see if each and every *action* met the virtue criterion, instead we formulate specific character dispositions that do meet it and attempt to cultivate these dispositions in ourselves. In effect, we are attempting to cultivate a core set of virtues we believe will allow us to live better, more flourishing lives. Such a core set of virtues may include such dispositions as being honest, moderate, caring, loyal, brave, wise, industrious, or humble.

For several reasons that will be illuminated throughout this essay, *humility* passes the virtue criterion. First of all, humility sensitizes us to the responsibility we have to minimize our impact on other life forms and the ecosphere by not taking life for granted. Since we are not autotrophs, in order for humans to survive other living beings must die. The legitimacy of these beings giving their lives for our continued survival demands our humility. By minimizing any unnecessary harmful effects we will allow the animate world more freedom to work towards its own self-directed mode of flourishing. When we work to cultivate this virtue we will begin to see all organisms as *ends-in-themselves* and no longer look at them as simply means to human ends. Secondly, humility teaches us that we can't acquire absolutely certain knowledge and that our understanding of any situation is always only approximate. Humility admonishes us to act with prudence and caution when we are dealing with activities or situations that may have contingent effects beyond

[5] Richard McKeon. *Introduction to Aristotle*. New York: Random House, 1947; p. 118.

our conceptual grasp. When we find ourselves faced with the application of never before extant transgenic organisms, we must understand that it is always better to err on the side of humility than hubris (for reasons to be enumerated in the following paragraphs). So, for these reasons humility meets the virtue criterion because it creates a space to allow individual human and collective human societal flourishing along with the flourishing of the non-human animals, natural processes, and ecosystem processes that are interconnected to the subjectively perceived human world. This makes it an important benchmark from which to gauge our moral deliberations.

Why should humility become an important virtue informing our moral deliberations in relation to matters of biotechnology? As Bernard Rollin has carefully described in several books and essays, the scientific community's singular failure has been inadequate engagement in the moral issues arising from scientific activities. Examples of scientific impropriety and hubris are both legion and replete throughout the discipline. A small sample of moral infractions made possible by scientific hubris include: the death of Jesse Gelsinger, Baby Fae, livestock confinement and antimicrobial resistance, the Willowbrook hepatitis experiments, the Tuskegee syphilis study, DDT bio-accumulation and subsequent detrimental effects on wildlife and ecosystem functions, the bubble-boy David Vetter, and the seemingly constant recall of prescription medications. These instances occur because science in many respects seems more concerned with personal ambition and profit than the pursuit of truth. The reason that disaster results in the cases described, as Rollin points out, is not because some area of knowledge is inexorably dangerous, it is rather that scientists tend to be cavalier about the dangers emerging from science and technology, and to rush headlong into a field or activity with incomplete

knowledge that leads in itself inexorably to disaster.[6] In the following paragraphs I will more closely examine several of these cases to illuminate exactly how they may be seen as examples of the harmful effects of scientific hubris.

In the cases of the deaths of Jesse Gelsinger (who suffered from Lesch-Nyhan syndrome) and Baby Fae the scientists involved seemed to place a higher value on their own careers than the well-being of another person. For example, although Gelsinger's condition was stable, he was convinced to try a radical gene-therapy procedure that led to his death just four days later. Despite the death of several monkeys that had undergone this same procedure, the researchers were convinced that their experiment would be a success. The doctors in both cases were so confident of their own knowledge that they were willing to bet someone else's life on it. Unfortunately for Gelsinger and Baby Fae, they were wrong. The Willowbrook and Tuskegee cases are both similar examples of scientific hubris, but in these cases the doctors were willing to put the health of entire populations in jeopardy in order to study a particular disease. In all of these cases the health of the individual was sacrificed to achieve some theoretical scientific good which was dictated, of course, by the scientists themselves.

The dominate form of intensive confinement livestock breeding is heavily dependent on antibiotics. Proponents of the practice claim that without it they could not produce cheap food for Americans and the needy peoples of developing countries. Unfortunately, such extensive application of antibiotics has bred antibiotic resistance into pathogens that directly affect human health. But this is far from the only degenerative effect the overuse of antibiotics has spawned. As Rollin notes, "Food safety is also relevantly affected in an industrialized agriculture based on technological fixes such as

[6] Bernard Rollin. *Science and Ethics*. Cambridge: Cambridge Uni. Press, 2006; p. 155.

subtherapeutic use of antibiotics."[7] For example, factory farm effuse contaminated drinking water in Wisconsin and caused a cryptosporidium outbreak that sickened 400,000 people and led to over 100 deaths.[8] Up to 71% of store-bought chicken is contaminated with Campylobacter and/or Salmonella.[9] Iowa State University found that 70% of all swine confinement workers suffer from some form of respiratory illness or irritation.[10] Studies also show that people living near large hog farms suffer significantly higher levels of upper respiratory and gastrointestinal ailments than people living near other farming areas.[11] Also, these confinement operations excrete 150 times more organic waste than that produced by humans, which represents a large and growing reason 60% of American streams are classified as polluted or impaired. The scientists involved with these forms of agribusiness commonly act from hubris because they believe that they understand all the relevant variables related to their activities, and for the sake of efficiency and profit they continue to defend these practices against the barrage of studies showing that these intensive confinement agricultural feeding operations degrade environmental quality and are detrimental to human health.

The David Vetter case chronicles three doctors from Baylor College of Medicine who informed the Vetter family that they had a 50 percent chance of having a child with severe combined immune deficiency syndrome (a rare genetic disease). If they *did* then the child would be placed in a sterile isolator – a bubble – until a cure could be found and

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[7] Bernard Rollin. "Ethics, Science, and Antimicrobial Resistance." *Journal of Agriculture and Environmental Ethics*. 14: 29-37, 2001; p. 35.
[8] David Letson and Noel Gllehon. "Confined Animal Production and the Manure Problem." *Choices*. 1996: 3rd Quarter, pg. 14
[9] Consumer's Union. Press Release: *Consumer Reports Finds 71 Percent of Store-Bought Chicken Contains Harmful Bacteria*. February 23, 1998.
[10] Iowa State University. *Livestock Confinement, Dust, and Gases*. Iowa State University: University Extension, 1992.
[11] Kelley Donham. *Community and Environmentally Acceptable Livestock Production: Defining the Challenge*. Presentation at Animal Feeding Operations and Ground Water Conference, November 1998.

the project would be completely funded with federal research grants.[12] David Vetter was conceived because his parents believed that the scientists could save their child. Instead, David lived a very impoverished existence – never even experiencing the touch of another human being – inside a bubble before he died at the age of 13 when doctors attempted to cure him with a bone marrow transplant. The leading researcher, John Montgomery said in 1997, "If people didn't take chances, none of us would be here. Columbus would have stayed in Spain and would have been selling tortillas, because he was warned he would sail off the edge of the earth."[13] Here it was hubris that had scientists willing to put a family through incredible anguish and pain in order to have a unique testable subject.

Rachael Carson describes the extent of scientific hubris to detrimentally affect the natural world in her book, *Silent Spring*. While utilizing dangerous chemical compounds developed for biological warfare, farmers were told they had been provided a chemical quick-fix to alleviate their crop losses to pests. The companies that produced DDT were more interested in their net profit than allocating research funds to discover what adverse effects the use of DDT would have on the environment and non-target species (such as bald eagles). Amazingly, some scientists believed that it would have no significant adverse affects at all! We are still dealing with the environmental challenges DDT created, due in no small part to scientific hubris.

Now that we've explicated a general overview of virtue theory – both what virtues are and why they should be cultivated – and contrasted the virtue of humility with scientific hubris, we may turn our attention towards the moral issues pertinent to GM crops. Genetically engineered plant cultivars have had genes from other organisms

[12] Steve McViker. "Bursting the Bubble." *Houston Press*. April 10, 1997.
[13] Ibid.

inserted into their DNA sequence. It should be noted that human beings have been using interspecies hybridization for thousands of years. Opponents of GM crops often argue that it is disrespectful to modify a plant using recombinant DNA techniques. But it doesn't seem any more disrespectful than the processes incorporated by either modern or traditional forms of agriculture. (Indeed, some GM crops may posses a lesser degree of genetic recombination than a botanical hybrid. Also, traditional hybridization has created its own list of harmful, unexpected side-effects.) While a component of humility is respect for life, I don't feel that GM crops fail the virtue criterion on this point. People have been selectively breeding plants for specific purposes for as long as we've practiced agriculture, but what makes GM crops different is that they incorporate biotechnology that allows us to transfer genes between completely unrelated species (such as a tomato and a salmon). This means that the resulting genetic variant will be something that nature would not have been able to produce through natural evolutionary processes. So, are such genetic variants examples of scientific hubris, similar to the cases described above, therefore violating the virtue of humility? Because we are examining this question from the unique viewpoint of virtue theory, our answer will be nuanced; in effect, whether or not a GM crop embodies a position of humility depends on salient factors, the most important of which is how it addresses current agricultural challenges.

In his final paragraph concluding his argument against indiscriminate use of subtherapeutic antibiotics in confinement agriculture, Rollin states,

> It may well be a last call for us to back off from chasing high-technological fixes in agriculture and cheap food, prevent its ingression into developing countries, and to begin to pursue a more thoughtful, sustainable, humane, community-preserving agriculture, one that stresses harmony between humans, animals,

> health, and nature, not perpetual overcoming of nature and chasing of high-tech solutions generating high-tech problems.[14]

Here, Rollin draws attention to the role of scientific hubris in creating some of our most pressing environmental and human health problems. Any particular technology or activity that is likely to degrade essential ecosystem processes and subsequently reduce the potential of human flourishing will not pass the test of humility (and therefore fail the virtue criterion). Many GM crops tend to eliminate non-target species and due to their dependence on monoculture agriculture they exacerbate the problems of soil erosion, desertification, topsoil loss, and the further contamination of adjacent watersheds. According to the Worldwatch Institute, almost 20 million km^2, or 15% of all land surfaces, is experiencing a significant degree of erosion, salinization, and overall soil degradation due to our uncritical reliance on the use of pesticides, herbicides, and the planting of homogeneous mono-crops, among other pernicious agricultural practices.[15] Transgenic crops don't address these problems because they are part of the industrial paradigm claiming that a single control mechanism will manage pest populations. Current research shows that the use of GM crops is likely to increase the use of pesticides, accelerate the evolution of "super-weeds," and further entrench monoculture agriculture to the detriment of genetic biodiversity.[16] Transgenic crops are often lauded as biotech "quick-fixes." This tends to result in genetic engineering accelerating the tendency to rely on one genetic strain as a magic bullet remedy to solve critical agricultural challenges. This results in our crops being more susceptible to pathogenic or even pest devastation (since pests can adapt to a particular pesticide in a few generations). Technological quick-fixes, as Rollin

[14] Bernard Rollin. "Ethics, Science, and Antimicrobial Resistance." *Journal of Agriculture and Environmental Ethics.* 14: 29-37, 2001; p. 37.
[15] C. Bright, *Tracking the Ecology of Climate Change*, 78-94.
[16] R. Hindmarsh. 1991. "The Flawed Promise of Genetic Engineering." *The Ecologist* 21: pp. 196 - 205.

mentions, tend to generate unforeseen technological problems. They also embody a general disposition to further control and dominate natural processes through anthropogenic means to promote anthropocentric concerns. "The human presumption that we are capable of a technological fix demonstrates (once again) the arrogance with which humanity surveys the natural world. Whatever the problem may be, there will be a technological, mechanical, or scientific solution."[17]

I'm not arguing here that we should eschew biotechnology in all its forms (I'm not a Luddite after all), rather what I'm claiming is that scientific ideology's unreflective, dogmatic acceptance of the belief in technological or scientific fixes has led to many of the problems our society faces today. This is the root of scientific hubris illuminated in the case studies described above. It is not hubris to make use of technology, but only hubris to rely solely and uncritically on it. As a species we are confronted with many pressing agricultural challenges, but these may best be remedied by incorporating non-technological, non-manipulative responses instead of quick-fixes. By cultivating humility in our agricultural and environmental practices we will be better able to create opportunities to preserve goods necessary for and conducive to human and environmental flourishing as described by the virtue criterion. This process may be better promoted through humility than domination and control. Instead of relying on the development and dissemination of transgenic crops to solve our agricultural problems, we should work toward modifying our lifestyles, including our diets, and our agricultural practices so that they are more attuned to the limits and distribution of our resources.[18] This is a transition away from scientific hubris towards the virtue of humility.

[17] Eric Katz. 2000. "The Big Lie." In W. Throop, ed., *Environmental Restoration*, 83-93. NY: Humanity.
[18] Ronald Sandler. *Character and Environment.* New York: Columbia Uni. Press, 2007; p. 136.

Does this mean that we are never morally justified in utilizing GM crops? The argument above should, at the very least, rule out any uncritical, indiscriminate use of these biotechnologies. But some forms of transgenic crops *may* not come from a position of hubris and subsequently support the degenerative processes described above (such as soil erosion, monoculture agriculture, or loss of genetic biodiversity). One such candidate is golden rice. Golden rice was created by combining two daffodil genes and one bacterium gene into the rice genome. This transgenic modification allows the rice to produce beta-carotene (vitamin A). Scientists at the Swiss Federal Institute of Technology plan on crossbreeding the rice with popular cultivars that are regionally appropriate. The rice will then be offered, *free of charge*, to people in developing nations whose diets are primarily constituted by rice. The World Health Organization has found that approximately 150 million children in such countries suffer from a vitamin A deficiency – an aliment that may cause impaired vision and increased susceptibility to various infections. Golden rice is not being billed as a magic-bullet solution to vitamin A deficiency; rather it is being promoted as one element in a greater scheme to compliment traditional sources of the nutrient. Therefore, the utilization of golden rice should not encourage traditional rice growers to adapt chemically intensive monocultural agriculture. By incorporating the gene into local cultivars, golden rice should not reduce inherited genetic biodiversity. Also, the genetic modification should not confer any obvious fitness advantages over local varieties.[19] Since the genetic modification seems to address the agricultural challenges that have been enumerated, this appears to be an example of a GM crop that may pass the test of humility. If everything that the Swiss Federal Institute of Technology claims for golden rice is true, then humility would encourage the continued

[19] Ronald Sandler. *Character and Environment.* New York: Columbia Uni. Press, 2007; p. 128.

development and eventual field trials of the transgenic crop while taking into consideration the critique of scientific ideology offered by virtue theory.

By remaining humble in our relationship to the natural world we will act from a place of caution and prudence. We should be aware that we can only obtain approximate knowledge, and that at no moment do we ever have absolutely certain knowledge pertaining to all the contingent variables weighing in on our moral and scientific deliberations. Virtue theory teaches us that our beliefs are more than just mental states; they are dispositions to act in certain ways. We must ask what sort of systems we want to support and what type of society we want these systems to engender. By cultivating humility in our moral interactions we will be less inclined to act from hubris and more likely to create, as Rollin states, systems that sustain thoughtful, sustainable, humane, community-preserving agriculture, that stresses harmony between humans, animals, health, and nature.