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Reflection Paper

This course, the History and Ethics of Biotechnology, provided a prism through which I was able to engage with many different issues relating to the intentional manipulation of genetic material. Whether the application under consideration was for agricultural, medical, diagnostic, or enhancement purposes, the course readings and discussions encouraged me to look below the surface to seek out the assumptions, motives, and values that fuel many of these debates. I came into the course feeling generally positive about the "promise" of biotechnology/genetic engineering and intrigued by the ethical and social dilemmas that these technologies will - indeed, do - pose. I finished the semester far more wary and skeptical. The "good" that might come from certain applications - such as the ability to test for genetic diseases - is counterbalanced by the knowledge that few treatments or therapies currently exist, for example. The manipulation of a crop such as corn by inserting a gene that makes it toxic to certain insects seemed too good to be true - and it was, as probably any ecologist could have predicted. It was found that "refuges" of non-Bt corn needed to be established to serve as breeding grounds for 'normal' insects, so that random Bt-resistant insects would not mate with each other and produce offspring that would annihilate the genetically-modified corn. 'For every action, there is a reaction' is a truism that seems especially tailored for biotechnology.

Not every issue we discussed or read about resonated equally with me, but all were fascinating. I was interested in the historical development of molecular biology as a discipline - why it came to the fore and who were its proponents; what mindset underlay the explanatory framework held by those who saw the gene as the ultimate organizing structure. From the Lily Kay book, *The Molecular Vision of Life: Caltech, the Rockefeller Foundation, and the Rise of the New Biology*, I learned how patronage, funding priorities, institutional philosophy and reputation, and individual personalities can guide and influence what kind of science is done and toward what ends. From the Sheldon Krimsky book, *Biotechnics and Society: the Rise of Industrial Genetics*, I took away the idea that people in society can and must have a role in determining how the biotech revolution is played out. He proposed a template for technology assessment that included seven factors: ecological impacts, health effects on humans, ethical soundness, economic productivity, distributive justice, social

needs, and market demand. These variables would be assessed by a system of weightings that could result in a matrix helpful to decision-makers for framing a particular issue or product in a holistic manner. Of course, there could still be different arguments and perspectives with regard to each variable (e.g. whether something is ethically sound or not) but the idea of having a method to systematically address these facets is encouraging and preferable to the simplistic pro/con debates that characterize how we currently deal with problematic issues.

The course delved into the issues surrounding the Human Genome Project, gene therapy and genetic screening/testing. The Daniel Kevles book, *The Code of Codes*, provided a wealth of viewpoints about what the completion of the sequencing of the human genome may spawn in terms of applications and products. I found Dorothy Nelkin's chapter in Kevles, as well as her book *Dangerous Diagnostics* to be very persuasive in terms of urging caution with respect to genetic tests. Her contention that genetic testing encourages categories such as the "pre-symptomatic ill" dovetailed with Evelyn Fox Keller's discussion of the concept of "genetic disease" (which she attributed to Edward Yoxen). These perspectives revealed to me how most of the debates about biotech applications are conducted on a surface level only. When you step back and widen the lens to the social, as opposed to individual - level, an issue like genetic testing may have its greatest impact on our concepts of deviance and/or disease. Who defines health, who defines disease? According to Keller, the impression that there is a real baseline norm (even the human genome was actually a composite of a limited number of people) allows for the possibility that shortness, baldness, or other traits can theoretically be applied against this yardstick and be labeled as diseases.

The syllabus for this course was ambitious and comprehensive. I thoroughly enjoyed it as a survey of the many important developments that are taking place with and without our knowledge and input. Looking back on it, however, I would say that each of these issues could have been a course in itself! Our readings were very compelling, but the most recent was published in 2001, the earliest in 1989. I would be interested in following up fewer issues but in greater depth and currency. I feel that I received a good grounding in the basic issues -- now I would like to know more about, for example, the intellectual property issues surrounding the patenting of genes and what alternatives there might be to "owning" a sequence of proteins. I am interested in the blurring of the line between genetic "therapies" and genetic "enhancement." I would like to pursue the phenomenon of the rapid growth of genetic tests, especially the cottage

industry that has sprung up on the Internet. The stem cell research debate is also moving into new possibilities, especially as millions of dollars have been poured into it. The public debate on this issue that all commentators seem to want may become a fait accompli if commercial applications outpace its scrutiny by thoughtful people.

A key factor in my approach toward these issues has been my grounding in critical and creative thinking. In this tradition, Nadine Weidman, the very able and insightful instructor of the course, encouraged us to read the texts for their author's stated or unstated assumptions and values, to note their use of language, and to carefully examine the evidence they brought to bear - especially if it happened to coincide with our own point of view! Some arguments were easy to recognize - such as the many slippery slopes intoned by Jeremy Rifkin. Others were less obvious - one read all the way to the end of Daniel Charles' *Lords of the Harvest* without knowing definitively where he stood on the issue of agricultural biotechnology. It was a challenge to respond to the assigned essay topics in an analytical or critical manner, but it would be even more challenging to try to come up with a solution or range of solutions to some of these problems. Not that I think there is a discrete moment in time to ask: "it's technically possible - should we do it?" - but it would be a good exercise to have to respond to such a question by proposing a creative juxtaposition of alternatives, for example, or by constructing a scenario that would assist people to decide where they stood on a spectrum of choices - from laissez faire to full regulation.

Finally, I am happy to report that even someone with no science background can readily understand and appreciate enough of the science to try to make sense of these momentous developments in biotechnology. Although many of the people in my class were in the biotech industry - working in labs or in genetics companies - there was a level playing field when it came to grappling with the social and ethical implications of, say, stem cell research or creating chimeras. Agricultural biotechnology and genetic engineering are not fringe issues; they are important topics about which all thinking people can and should inform themselves.