

Preliminary Aspects of Biotechnology

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History

Prior to the 1970s, most research and development in biotechnology was publicly funded, either directly by the government, or through major research universities. The work was intense, slow and very difficult. As the momentum built around biotechnology within the sciences, there were worries of moral and ethical problems dealing with controlling life. Furthermore, the public was in the middle of a scientific backlash. After being promised the world through science in the 40s and 50s under the ideologies of Vannevar Bush, people were starting to question if we were pushing too hard into areas which we should not go. A major environmental movement was growing just as the United States ran into the 1970 energy crisis.

All the while, the science of biotechnology was advancing. A big breakthrough was by Stanley Cohen and Herbert Boyer. In 1973 they succeeded in splicing together the DNA from two bacteria by using restriction enzymes. Realizing the importance of this monumental achievement, Stanford University immediately applied for a patent over the process of recombinant DNA (rDNA). At the same time, scientists around the world, recognizing the inherent danger of playing with nature, called a moratorium on rDNA research. But it was only a short while before research continued with very little control in place. Although chemical processes were known to be patentable, in 1980, the Supreme Court ruled that it was possible to patent engineered organisms. In the same year, the Bayh-Dole Act was passed, allowing publicly funded research to pass into private hands, as in to be patented by a private party or corporation, for bringing to the public. These three milestones allowed the biotechnology sector to take off flying in both the public and private sector.

The Good

Of course biotechnology, like the other sciences before it, offers a literal panacea. And as such, research that would bring the panacea about was heavily financed by both government and private industry. Finally we will be able to cure all disease by the use of biotechnology. We have already used biotechnology to determine factors that promote or retard the development of some cancers. Biotechnology will allow us to grow more and better foodstuffs, and purify our water. We now have corn that grows faster and bigger with no fertilizer than standard corn. Biotechnology will be able to bring us organisms that can generate energy at far greater efficiency than what we have today. Recently, a research project at the University of Massachusetts created a bacteria that creates electricity from sugar.

The Bad

Yet, we come back to the issues surrounding the creation of the biotechnology revolution; the Bayh-Dole Act and the rDNA patent. One needs to understand the practical background of how the

patent system works within the United States. The system is set up to favor large, rich corporations with the finances to own vast patent portfolios. Many companies today exist solely just to own and license patents. The Bayh-Dole Act allows research that was paid for by public funds to be transferred to companies and individuals who are not responsible to the public. Understandably, universities are not set up to mass produce foodstuffs or cures, but the public has already shouldered the burden. How can they be expected to pay for the pure profits that the corporations will collect. Obviously, this problem reaches farther than just biotechnology.

Although it may not be a pleasant thought, corporations exist solely to benefit the shareholders and investors. Responsibility to society, customers and even employees is secondary. Evidence of this is seen in both recent and past corporate scandals. Can these companies be trusted to control the future of life on the planet and to make a profit while doing so? A recent example of these concerns are seen in the SARS outbreak of this year. When researchers finally isolated the organisms causing Severe Acute Respiratory Syndrome, they immediately patented the techniques and organism but wrote the patent to grant rights to everyone. This was done because scientists feared corporations would patent the information and thereby maintain ownership over future research and possibly a cure.

Yet public institutions are not too far behind their private counterparts. No one could argue that finances and returns on investments are not important at a university. Just look at our own university. Why are millions of dollars being spent to open the Life Sciences Institute? The easy answer is because of all those wonderful things biotechnology offers. The real answer is because life sciences and biotechnology offer a huge financial return, greater than all other areas of science.

And through all this, the issue of systematic controls and "righteousness" have not yet been accounted for. It seems like a good thing to make better corn, but it turns out that some strains of genetically modified corn produced highly toxic pollen that was killing butterflies. Is it okay then to modify the entire ecosystem at the genetic level purposefully for better or for worse? Despite the limited controls put in place at the Asilomar conference in 1975 and the laws since then, Pandora's box has been opened. If we place further restrictions, the science will take place elsewhere, possibly with less control.

Conclusions

I am no Luddite. As an engineer, I believe that science can be used to solve many of the worlds problems, as well as provide for greater luxury. Yet I cannot overlook the effects of greed and societal disregard shown by both corporations and individuals. Knowing this, I both look welcome and fear biotechnology.