1999

The Biotech Century (Book Review)

Philip A. Reed

Original Publication Citation
Reed, P. A. (1999). The biotech century. [Review of the book *The biotech century,* by J. Rifkin]. *Journal of Technology Education, 10*(2), 72-75. https://doi.org/10.21061/jte.v10i2.a.5

Book Review

Rifkin, J. (1998). *The Biotech Century*. New York, NY: Penguin Putnam, Inc. $25.00 (Hardcover), 272 pp.

Reviewed by Philip A. Reed

The Biotech Century discusses many of the biological processes, technologies, moral dilemmas, and political issues that now face humanity for the first time. This book is relevant to technology educators for several reasons. First, recent research shows that biotechnology is an important emerging field of study. The Technology for All Americans project has determined that biological systems is one of the three contexts of technology (International Technology Education Association, 1996). More recently, although on a smaller scale, Brown, Kemp, and Hall (1998) have determined that biotechnology is an emerging content area that should be addressed by teacher educators at the pre-service and in-service levels. Secondly, *The Biotech Century* can provide technology educators with a base knowledge as they look for ways to incorporate biotechnology into their curriculum.

Author Jeremy Rifkin begins by claiming that humanity is leaving the communication era and entering a biological revolution. Mr. Rifkin has compiled an impressive list of references to support his claims in *The Biotech Century* but writes in a style that allows readers to draw their own conclusions. Mr. Rifkin is the author of fourteen books relating science and technology to the economy. As founder and president of the Foundation on Economic Trends in Washington D.C., he often speaks and consults nationally and internationally on a wide range of topics dealing with science and technology.

According to Mr. Rifkin there are seven strands that make up the "operational matrix" of the Biotech Century. The first strand is recognizing the ability of science to identify, isolate and recombine DNA to be used as a raw material. Historically, plant cultivation and animal husbandry have been limited by species restraints that are put in place by nature. Now, man can completely manipulate and engineer new forms of life. Some of the new forms of life are impressive: mustard plants that grow chains of polymers, microorganisms that strip undesired elements from raw materials in mines ("bioleaching"), and the use of microorganisms to render waste and pollutants harmless ("bioremediation").

With this new ability to alter life come the issues of patenting and commercialization. This second strand of the Biotech Century has started a race by governments, private companies and individuals to lay claims on the building

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Philip A. Reed (preed@vt.edu) is a doctoral student in the Technology Education Program, Department of Teaching & Learning, Virginia Polytechnic Institute and State University, Blacksburg, VA

blocks of life through billion dollar research projects and legal patents. Ironically, the nations of the southern hemisphere, which abound in natural resources, are the nations least informed about biotechnology. Already there are heated debates in world courtrooms and the United Nations about the extraction and use of these natural resources. Often, these resources are used by corporations to turn huge profits with little or no return to the nations who claim these regional forms of life.

The power of biotechnology is fully realized when one contemplates the release of some of these engineered life forms back into the natural environment. Mr. Rifkin calls this "a laboratory-conceived second Genesis." A historical review reflects how farming practices have domesticated certain crops and animals over the centuries. In India just fifty years ago, for example, there were over 30,000 varieties of rice. Now, there are ten dominant varieties. *The Biotech Century* asks what will happen to the balance of nature with the release of these "super" crops and microorganisms? Rifkin points out that many of the world's seed companies are already producing and marketing products that have been altered. Although these are altered to resist elements such as drought and pests, newer crops can be engineered to produce chemicals and medications. What will happen to the soil in which these crops are planted or the insects that feed on these new hybrids?

The fourth strand of the coming Biotech Century relates to eugenics and the human genome project that is being conducted by the National Institute of Health. This highly publicized project has already created discussions concerning human genetic screening for pre-natal, insurance, and employment purposes. Rifkin takes this issue one step further, however, by looking at the social and political histories of Nazi Germany and the United States prior to World War I. While most people are familiar with the atrocities of the Nazis, many are not familiar with the American Breeders Association or the immigration and sterilization laws in the United States during this time period. These laws, according to Rifkin, were put in place to allow the genetically fit aristocrats to maintain their power. Although this line of thinking in the United States finally faded during the events of World War II, Rifkin feels it could re-surface. Most people today would agree that diseases and birth defects should be eliminated from the human genome through negative eugenics. Going beyond the issue of human suffering however, Rifkin asks who should determine which genes are desirable and which are undesirable.

While genetic selection may be an issue of the future, some biotechnology issues are already affecting the social fabric of our culture. In California, for example, a PET Scan of a persons brain can be used as evidence in court to determine if a criminal is predisposed to recommit a crime. Rifkin feels that this new sociobiology that places nature over nurture is gaining widespread acceptance. A direct impact on education can be seen when we look at the history of labeling special education students. During the 1960's and 1970's, over-active students were thought to be a product of their environment and they needed special attention. In the 1980's and 1990's, however, Attention Deficit

Hyperactivity Disorder (ADHD or ADD) was diagnosed as a biological disorder that can be treated by drugs.

The paradigm shift from nurture to nature and the shift from the communication age to the bioindustrial age have not occurred overnight. Rifkin's sixth strand in the operational matrix explains how the Biotech Century would not be possible without the forbearing communication age and the use of computers. When fully complete, the *basic* human genome database will equal a telephone book that contains three billion entries. Once genetic differences are factored, the database will be ten thousand times the size of the original database. And this is just for the human species. Computer networks will allow similar databases for thousands of species to be stored and accessed all over the world. When new species are genetically mapped, this data can be accessed and mixed with other species electronically in virtual reality environments.

The computer itself could be drastically changed through the use of DNA instead of silicon in microchips. DNA chips are created through photolithography just like silicon chips. The basic structure of DNA can be programmed to emulate the gates of a silicon computer chip. The advantage of DNA over silicon however, is the fact that it naturally handles data in a parallel manner and therefore is immensely faster than silicon. This discovery helped the first DNA computer solve a simple math problem in 1994 .

Rifkin's final operational matrix for the Biotech Century talks about a new cosmology that is challenging the Darwinian view of nature:

> The ability to reduce all biological organisms and ecosystems to information and then to use that information to overcome the limitations of time and space is the ultimate dream of biotechnology (p. 217).

This new cosmology pictures nature, on every level, as a gatherer of information. Even the smallest organisms respond and evolve according to information. The circular model of cybernetic interaction, feedback, and adjustment is how this new cosmology views all life forms. Rifkin elaborates this cosmology on the human level by explaining how the gene has become a cultural icon that is used as a social force for determining where diseases come from, who is a genius, and even who has the potential of being a criminal.

The Biotech Century leaves the reader with two rather bipolar possibilities for the future. One is the possibility of large scale genetic engineering. The second is the use of more conservative ecological and preventative health practices. Rifkin selected the second option as the obvious path for biotechnology in the future and turns again to history for support. By comparing the fear of nuclear abuse to the fear of biological abuse, Rifkin concluded that the development of biotechnology will be swift but its implementation will be closely monitored. Emerging international regulations for both of these technologies clearly support Rifkin's theory.

The Biotech Century is an informative book for all, but it has special implications for the technology educator. As Wells (1994) pointed out, biotechnology has become too large and too influential in our society to be taught solely in the physical science curriculum. The technologies, issues, and

vocabulary introduced by Rifkin can aid technology educators as they work biotechnology into their curriculums. While biotechnology is currently taught in some technology education programs (see Johnson, McAdams, and Pontarolo, 1998), these programs are exceptions to the norm. By reviewing works such as *The Biotech Century* and Wells' (1995) taxonomy, technology educators will be better informed and equipped to implement sound classroom instruction on biotechnology.

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