**Step Three Resource: “Biotechnology: What is it and is it Safe?” (article title) by Norma Reiners and Don Roth**

Extension staff are expected to respond knowledgeably to questions about major issues affecting the environment, agriculture, and the home. Biotechnology is one of these issues. What do you say to someone who asks you, "What is biotechnology? Is it safe?"

**What Is Biotechnology?**

In a general sense, biotechnology has been used by humans for over 10,000 years. Early humans recognized that microscopic organisms such as bacteria and fungi were useful in making cheese, bread, wine, and beer. A giant step for biotechnology occurred in the 1860s when Gregor Mendel explained the genetic basis of heredity, thereby providing a scientific foundation for the rapid improvement of plant and animal species through natural selection and cross-breeding (hybridization).

These fundamental processes are still being used, but now we have the ability to select specific genes and manipulate them much quicker than allowed by traditional methods. So today the term "biotechnology" is used in a more restricted sense to mean the application of molecular biology techniques to identify genes responsible for particular traits; to clone, study, characterize, and manipulate them; and finally, to insert them into different organisms. It's difficult to image an area of agriculture or life that can't be affected.

**What Can Biotechnology Do?**

Some current biotechnological research activities include:

* Developing crops with increased resistance to salt, heat, cold, drought, or flooding. "Frostban," a genetically altered bacteria that gives plants greater resistance to frost, is currently being tested on strawberries in California test plots.
* Conferring nitrogen-fixation capabilities on a wider variety of plants, including grains and vegetables. This would reduce the need for expensive fertilizers.
* Control of photosynthesis in farm and forest crops. Genetic changes that result in reduced photorespiration (the loss of photosynthate to oxygen) would help raise productivity in many major crops.
* Disease and weed control. For example, popular herbicides containing triazines would be more effective if crop plants were protected by genetically imparted triazine resistance.
* "Engineered" animal embryos to improve growth rate, disease resistance, and protein content of the developing animal.
* Enzyme and protein products to improve animal digestion and increase the efficiency of milk and meat production.

Clearly, the impact of biotechnology on agriculture can be enormous.

**The Risks**

The development of this new technology has quite naturally raised concerns about public safety and welfare. The most publicized risk of biotechnology is the inadvertent escape and subsequent establishment of recombinant organisms in the environment. Scientists involved in biotechnological research are keenly aware of this and other potential risks, and they seek to minimize and control them. That's why committees at university, state, and federal levels have been formed to review and oversee biotechnological research. But fears abound - fears that researchers at universities are no longer scientifically neutral, or that politicians are moved by special interest groups. The public should know if narrow, short-sighted, research goals are being put ahead of long-term, public welfare.

**Public Assessment of Biotechnology**

A nationwide survey commissioned by the Office of Technology Assessment in November 1986, revealed that 66% of the American public expects genetic engineering to make life better for all people. But, 52% believed genetically engineered products are at least somewhat likely to represent a serious danger to people of the environment. At the same time, only 19% of Americans (one in five) said they'd heard about any potential dangers of genetically engineered products. And, 82% of the American public believed that research in genetic engineering and biotechnology should be continued.2 The magnitude of this support isn't surprising since there has never been a biotechnology-related incident resulting in danger to humans, animals, or the environment.

**Is Biotechnology Safe?**

Biotechnology can be safe, but potential risks exist. The continued safe use of biotechnology requires constant vigilance on a case-by-case basis.

Scientists are responsible for careful preparation of recombinant organisms involved in research or product development. Agencies such as the U.S. Environmental Protection Agency and Department of Agriculture are responsible for monitoring the release and application of these organisms. The public, while realizing the enormous benefits of biotechnology, is responsible for understanding the potential risks and for taking an active role in political decisions regarding biotechnology.

**Where To Get Information**

Biotechnology literature is readily available in most public, college, and university libraries. Books,3 journals,4 magazines, newspapers, pamphlets, and brochures offer information for novices and experts. Information is also available at most land-grant universities because of active research and teaching programs in biotechnology. Administrators and faculty with responsibilities in this area generally welcome an opportunity to cooperate with Extension in developing educational programs. In addition, private companies that have biotechnology programs (for example, Monsanto and DuPont) are willing to provide brochures, films, and other forms of expertise.

Unnecessary fears fostered by ignorance must be reduced so that reasoned assessment of biotechnology is possible. There are risks, and the public has an obligation to know what's going on. Extension education programs targeted at explaining biotechnology research and applications should be given a high priority so people can answer for themselves the question: Is it safe?