Study Guide to the FOOD FOR THOUGHT lecture:

Fulfilling the Promise of Crop Biotechnology for the Poor in Africa

Challenges for Science and Society

Presented by **Roger Beachy** at Oregon State University 22 October 2007

Slides and streaming video available at http://agsci.oregonstate.edu/orb/events

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About the speaker

Roger Beachy is the founding president of the non-profit Donald Danforth Plant Science Center in Saint Louis, Missouri. Beachy pioneered the development of virus-resistant plants through biotechnology; his early research led to the development of the world's first genetically modified food crop, a virus-resistant tomato. His laboratory conducts basic research on plant biology, and uses recombinant DNA-based technologies to improve crop plants like rice and sweet potato that are grown in developing countries.

Terms

Biotechnology: the collection of industrial processes that involve the use of biological systems – biotech is commonly used to brew beer, produce antibiotics, and improve food crops and livestock through breeding. For some industries, these processes involve the use of genetically engineered organisms.

Genes: molecules that carry inheritable instructions for making proteins in the cells of living organisms. The proteins coded for by genes determine an organism's traits, or characteristics. Interestingly, some genes serve only to switch other genes on and off, and don't make a protein product at all.

DNA: The genes of all organisms consist of DNA. Even though organisms are very different, they all use similar proteins in their metabolic pathways, and they use similar genes to encode these proteins. Scientifically speaking, it's what the DNA makes that matters, not where the DNA comes from.

Genetic modification: a change in an organism's genes made through selection, hybrid breeding, mutagenesis, or genetic engineering.

Genetic engineering: a change in an organism's genes made using recombinant DNA technology. A genetically modified/engineered organism is called a GMO. (More often than not, GE crops are referred to as GM crops, but this is a bit of a misnomer, since all GE crops are GM, but not all GM crops are GE!)

Recombinant DNA technology: a series of procedures used to join (recombine) DNA segments. This technology makes it possible to take a gene from any species and place it into almost any other species.

Basic research (also called fundamental or pure research): research performed simply to advance knowledge. It is exploratory and often motivated by the researcher's curiosity and intuition. Basic research is conducted without any practical end in mind, although results often have practical applications.

Take-home messages

Begin by viewing Beachy's intro on streaming video (slides 3-7, segment 6:40-13:40).

- The problems of sufficient food production are significant – there is less and less food on the plates of the poorest people. Food production is most critical in Africa and South Asia where the challenges of population growth and environmental degradation are the greatest.
- Investments in agriculture from within many African and South Asian nations, and from external donors, have declined dramatically (e.g. Nigeria).
- The success of agriculture depends on an infrastructure that supports both food production and getting food to the hungry (education, transport, communications, etc).
- To be successful, agriculture needs this infrastructure to provide an economic driver.
- Improved seeds, including those developed via biotechnology, could be part of the solution to hunger.
- Poor nations will not be able to use GE crops to meet the needs of the hungry if the present regulatory climate does not change. The heavy regulation of GE makes it nearly impossible for non-profit organizations and academic institutions to develop crops that support food production in the third world.

Beachy explores these points throughout his talk, but we'll focus on a few segments, so that your total watching time is about 20 minutes. Read each question before you watch the selected segment on streaming video.

Questions

Short answer

1. When does Beachy recommend that biotech solutions to agricultural challenges be sought? (slide 20, streaming video 31:05-33:05).

2. Why did Beachy choose to pursue the genetic engineering of crops? (streaming video 33:00-34:00)

3. Beachy believes that enhanced crops that have low profitability for the private sector (big business) require support from the public sector (government), because the private sector doesn't have enough financial incentive to develop them. What is one trait he gave as an example? (slide 28, streaming video 50:10-51:10)

4. What does Beachy refer to as "the monkey on our back"? (slides 31 & 33, streaming video 54:05-58:05)

Essay

5. During the introduction to this lecture, OSU professor Steve Straus said, "The Earth's population continues to grow rapidly in the developing world – putting severe pressure on its ecological systems, particularly its soil, water, and climate. The development of genetically improved crops that are rich in carbohydrates, proteins, and vitamins – while also resistant to pests and climatic stresses – is a major tool for improving the economics and sustainability of agriculture. Breeding and genetic science, now informed by the ongoing revolutions in genomics and biotechnology, provide many new options for progress that were not available even a short time ago. However, whether the science has the power to substantially help in dealing with the scale and pace of environmental degradation and human need, and whether societies will provide the milieu – including the needed investment and legal systems – to permit the innovations to be employed on a scale that matters, is unclear."

   Give one example of a GE crop Beachy refers to in his lecture. (slides 21-23, streaming video 34:00-39:00)

In what ways might this crop counteract environmental degradation and simultaneously meet a human need? Please construct an answer 75-125 words in length.