BIO BIOTECHNOLOGY INDUSTRY ORGANIZATION

Genetically Engineered Animals
Frequently Asked Questions

Biotechnology Industry Organization
September 2010

Genetic Engineering of Animals

1. **What is genetic engineering?**
   Genetic engineering is the direct manipulation of an organism's genes. Genetic engineering is different from traditional breeding, where the organism's genes are manipulated indirectly. Thanks to this technology, scientists can precisely transfer beneficial genes from one animal species to another.

2. **What animals are being genetically engineered?**
   In research studies, animals that have been safely genetically engineered (GE) include cattle, pigs, chickens, goats, sheep, dogs, cats, fish, rats, and mice.

3. **Why are animals being genetically engineered?**
   As scientists have sequenced the genomes of domestic animals, more is known about genes and the traits that they control. By finding genes that control beneficial traits, we are able to precisely introduce those genes into another animal's genome, so the GE animal will possess that trait.

   One example is the Enviro-Pig™. Through genetic engineering, this animal emits 30 to 60 percent less phosphorus than traditional pigs fed the same conventional diet. This lessens livestock's impact in the environment.

4. **Is a GE animal an animal clone?**
   No. A GE animal has a deliberate modification made to its genome. In genetic engineering, scientists can precisely transfer a beneficial gene (for disease resistance, for example) from one animal species to another.

   Cloning technology is a type of breeding technology to produce an exact genetic copy of an animal – usually a high quality animal with desirable breeding traits.

Benefits of Genetic Engineering

1. **What are the benefits of genetic engineering?**
   Genetic engineering of animals offers solutions for improving public health and enhancing quality of life. The benefits include advancing human health, enhancing food production, reducing environmental impact, optimizing animal health and welfare and production of cutting edge industrial applications.

2. **What is the most important application of genetic engineering -- human health or food applications?**
   Genetic engineering provides significant opportunity to improve human health and the foods we eat. It follows that the regulatory process used by the federal government should equally apply to all possible applications, particularly agricultural animals, which by their nature, are food animals.

3. **What are the primary issues holding up realization of these benefits?**
   The primary issue holding up the realization of these benefits has been the lack of a U.S. federal regulatory process. However, in January 2009, the U.S. Food and Drug Administration (FDA) clarified the regulatory process for GE animals. Then on February 6, 2009, the FDA approved the first product from a GE animal in the United States. Now new approvals from the FDA of applications that are in the pipeline are needed. The lengthy delay in reaching this point has contributed to a lack of investor confidence as well as a decline in the availability of government research funding. The good news is that because of the published federal regulatory process the industry is now on a positive pathway to provide consumer benefits from new approved products.

General Questions:

1. **How many GE animals exist currently?**
   The numbers of GE animals in research facilities in the United States are unknown to BIO, but researchers/producers are required by law to keep records regarding their disposition.

2. **Are GE animals in the food supply?**
   No. To date, FDA has not permitted GE animals to be placed into the human food supply.

3. **Are GE animals tracked or labeled?**
   - Yes. As a requirement of the regulatory review process, all GE animals are identified and tracked throughout the research and development (R&D) process.
   - If GE animals or the products of GE animals have been approved and deemed as safe as conventional animals by the government's arduous review and approval process, then it should not be necessary to differentiate them. Some companies, however, may choose to voluntarily implement labeling programs for specific products for marketing and branding purposes.
   - BIO supports the labeling policies of FDA and USDA, which state that the labeling of foods is not required unless there has been a significant change in the nutritional components (or an anti-nutritional component) or other chemical characteristic compared to its conventional counterpart. BIO supports voluntary labeling of products.

4. **Will industry propose a supply chain management program for GE animals similar to that developed to track animal clones?**

- No. Since approved GE animals will be as safe as any animal and no different, there will be no safety or health reason for a supply chain management program.
- Industry is exploring other aspects for such a program, such as meeting marketing claims and identity preservation to track a branded product.

5. **How does genetic engineering affect animal welfare?**
   - Genetic engineering has the potential to greatly improve the health and welfare of agricultural animals. GE animals may be disease resistant, parasite resistant, and withstand stress. The beneficial trait can likely improve their well being because they will be more productive. Such animals may need fewer veterinary interventions, use of special feed supplements, or other growth stimulants.
   - BIO supports animal welfare as a high priority in the conduct of research and development with genetically engineered animals. Research institutions, biotech companies and producer groups engaged in the growing field of animal biotechnology place animal well-being as a top priority. The humane care and use of animals in genomics, cloning and genetic engineering is guided by rigorous regulatory review by the U.S. Department of Agriculture in accordance to the Animal Welfare Act. In many cases, third party and international organizations have established animal welfare guidelines for use by companies engaging in the genetic engineering of animals.

Regulatory Process

1. **Why regulate GE animal and their products?**
   It is important that the technology is approved as safe for humans, animals and the environment.
   - Industry recognizes that any new technology can create doubt and mistrust in some sectors. To forestall that doubt and to, in part, ensure consumer acceptance, strong regulation based upon an internationally recognized approval process will lead to more efficient commercialization of GE animals, processes and products.
   - The federal government set the precedent for science-based oversight of biotechnology through the development of its GE plant regulatory framework.

2. **Are all GE animals subject to regulation by the FDA?**
   Yes. The FDA has stated in Guidance 187 that any animal containing an rDNA construct intended to alter its structure or function is subject to regulation by FDA prior to commercialization. However, based on risk, there are some GE animals for which the FDA may not require a formal approval. In general, these include laboratory animals used for research. On a case-by-case basis, the FDA may consider exercising enforcement discretion for GE animals of very low risk, such as it did for an aquarium fish genetically engineered to express fluorescence (tradenamed "GloFish"). The FDA has stated that it does not anticipate exercising enforcement discretion for any GE animal of a species traditionally consumed as food, and expects to require approval of all GE animals intended to go into the human food supply.

3. **How many GE animals or their products are approved?**
   There is only one approved product in the world from a GE animal. That product is called ATryn®, a human pharmaceutical developed to prevent blood clots. This drug is produced in the milk of GE goats. It was first approved by the European Medicines Evaluation Agency (EMEA) of the European Commission in August 2006. It was also approved in the United States by the FDA in February 2009. In addition, as noted above, a type of aquarium fish that expresses fluorescence is marketed under regulatory discretion.

4. **What will be the next approved product in the United States?**
   BIO does not know what the next approved product will be in the United States. However two companies discuss their regulatory progress publicly. AquaBounty Technologies, a BIO member, has publicly announced its application with the FDA to seek approval for a rapid-growth salmon, the AquAdvantage™ salmon. The fish grows at two times the rate of conventional salmon to the same mature weight while producing safe and healthful salmon for human consumption, and reducing environmental impact.

   In addition, the Enviropig™, whose developer, the University of Guelph is a BIO member, has publicly announced its application with the FDA. The Enviropig™ produces dramatically lower levels of phosphorus pollution than traditional pigs, and has a decreased impact on the environment.

5. **The FDA finalized its regulatory guidance document in January 2009. What is the purpose of the guidance and what did the FDA say?**
   The purpose of the FDA Guidance for Industry 187 (the FDA Guidance) is to clarify the FDA regulatory framework for GE animals based on the New Animal Drug process of the Food, Drug and Cosmetic Act.

   The FDA laid out a process for the science-based review of applications and how they would lead to an approval. The proposed framework is similar to international guidelines published by the Codex Alimentarius Commission on July 4, 2008.

6. **Why is the Guidance important?**
   The FDA Guidance is the first policy statement published by the U.S. government describing how it regulates GE animals and their products. This system will ensure the products made available through this science will go through a thorough and transparent application process before being approved for the marketplace.

7. **Why is the New Animal Drug (NAD) framework the regulatory process supported by the biotechnology industry, food chain, producer groups, patient groups and consumer groups?**
   FDA's regulatory pathway, the NAD approval process, provides the following key elements of regulation for these animals:
   - The NAD pathway criteria can be applied to all genetically engineered animals equitably, including those agricultural animals developed for biomedical purposes and not for food.

- The NAD pathway has been used by FDA for the last decade, after scientific, regulatory, and legal experts devised this consensus-based framework to ensure coordination among all centers within FDA.
- It is a mandatory process that leads to a formal FDA 'approval.' Such formal recognition by the agency is necessary for both domestic and international government and consumer acceptance of the technology, leading to successful commercialization of the technology and products.
- This rigorous, science-based approval process has been demonstrated to be critical to consumer acceptance of the technology and the products that will result.
- The NAD process is consistent with key international guidelines for food safety risk assessment for GE animals that was adopted by the Codex Alimentarius Commission on July 4, 2008.

8. Does the FDA Guidance affect international trade?

- International trade has not been affected by release of the FDA Guidance. In fact, trading partners have active research programs in genetic engineering of animals.
- On July 4, 2008, the 176 member countries of the Codex Alimentarius Commission unanimously adopted international guidelines for the conduct of food safety risk assessment for genetically engineered animals.
- The FDA Guidance describes a framework similar to the Codex-approved guideline for evaluating food safety risk assessment of GE animals. The international guideline was the end product of work of a task force led by Japan and Australia, which expedited the finished document due to unprecedented support from countries around the world.

9. What is BIO's Guidance for Genetically Engineered Animal Stewardship?

- The mission of BIO's Stewardship Initiative is to institute and promote guidelines for the development and use of GE animals, which promote good animal welfare, enhance industry credibility, and comply with current regulatory requirements.
- BIO's Guidance for Genetically Engineered Animal Stewardship provides information for the development and implementation of stewardship programs for product developers in industry and academia that plan to engage in research, development and commercialization of GE animals.
- The Guidance is being developed as a series of educational modules that can be adapted to the specific activities pertinent to the user's own operations. The first module on Research and Development has been completed and publicly released.
- Additional modules that are planned for inclusion in the Guidance include Commercialization, Post-Market Monitoring, and Discontinuation - Product Recall.

For more information:

- For more information on AquaBounty Technologies' AquAdvantage™ salmon, visit the AquaBounty press room at http://www.aquabounty.com/PressRoom.

- Visit BIO's GE Animal Resource Center at http://bio.org/foodag/animal_biotech/#genetic.

- Visit BIO's Guidance for GE Animal Stewardship at http://bio.org/foodag/geanimalctr/20090814_GE_Animal_Stewardship_Guidance.pdf

- Visit FDA's GE Animals web resource page at http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/GeneticEngineering/GeneticallyEngineeredAnimals/default.htm

- BIO commissioned a scientific report in 2008 entitled *"Genetically Engineered Animals and Public Helath: Compelling Benefits for Helath Care, Nutrition, the Environment and Animal Weflare"* by Dr. Scott Gottlieb and Dr. Matthew Wheeler. It is posted at www.bio.org or click on this link: http://www.bio.org/foodag/animals/ge_animal_benefits.pdf

January 2010