NEW AGRICULTURAL TECHNOLOGIES AND MANAGEMENT TECHNIQUES

The discovery of DNA and research in genetics and molecular biology in the mid-twentieth century made possible a new approach to both plant and animal breeding through genetic engineering: the alteration of genetic material through direct manipulation of the DNA sequence. While the term "genetic engineering" (GE) is sometimes used to include anything from controlled hybridization to chemically or radioactively induced mutations, the following USDA definition suggests the most common usage of the term:

> *Genetic engineering is the manipulation of an organism's genes by introducing, eliminating or rearranging specific genes using the methods of modern molecular biology, particularly those techniques referred to as recombinant DNA techniques.*

GENETIC ENGINEERING IN AGRICULTURE

Genetic engineering is utilized in plants to induce characteristics that could: generate a higher yield for the crop; provide resistance to disease, insects or herbicides; enhance nutritional value; allow plants to thrive under unfavorable growing conditions such as cold, drought or soil salinity; increase pharmaceutical value; or create a plant more effective for phytoremediation (pulling pollutants from soil or water). While many of these objectives can be accomplished through traditional hybridization techniques, new varieties can often be created more quickly and in a more targeted way through genetic engineering.

An understanding of the basic principles is important because confusion arises when people generalize and use terms like biotechnology, genetic engineering (GE) and genetic modification (GM) interchangeably. For clarity, this segment will use, "GE" or "GM" (without a following noun) to refer to any of several technical *processes or techniques* for transferring genes between species (transgenesis),whereas the use of "GMO" or "GE" or "GM," with a corresponding noun, will refer to any organism, food, crop, animal, etc., resulting from such a genetic transfer.

The Evolution of GE Crops in the United States

The earliest advances in GE were in the pharmaceutical field. Insulin derived from recombinant DNA was first marketed in 1978, followed by the first genetically engineered vaccine in 1984. The enzyme chymosin produced from GM microorganisms, the first GE food application, was approved for use in cheese production in 1990. In 1994 Calgene, Inc., a biotechnology research company, received FDA approval to market the first GE food crop—the *Flavr Savr* tomato—which had been submitted for FDA review in 1992. This was followed by the introduction of several GE crops in 1995: insect resistant (Bt) corn; herbicide resistant (Ht) soybeans, virus resistant squash, canola with modified oil composition, and an (Ht) cotton. The same year also marked the regulatory approval of the first "stacked" GE seed, which was a cotton seed containing both a Bt and an Ht gene. Stacked seeds are also known as multiple stacked trait seeds (MSTs); they employ multiple genetically engineered genes and may combine one or more Ht and Bt combinations. Stacked seeds can provide resistance to multiple insects (a possible response to the emerging problem of Bt resistance) while at the same time providing tolerance to various formulations of herbicide (currently, glyphosate or glufosinate). As of 2013, stacked crops accounted for more than half of all U.S. corn and cotton. Genetic engineering is also being used to develop potatoes and apples that resist browning, such as the non-bruising potato submitted for FDA and USDA approval in May 2013 (this is an example of *cisgenesis*, where genes from the same species are used).

To date, FDA reports having completed 98 reviews of GE crops or traits proposed for commercialization. Farmers have rapidly adopted GE crops and expanded their production; by 2013, GE cotton and corn represented 90% of planted acreages while soybeans and canola represented 93 % of respective acreages. According to the Grocery Manufacturing Association, "70% to 80% of the food we eat in the United States, at home and away from home, contains ingredients that have been [produced from] genetically modified [crops]. GMOs are also expanding worldwide; a record 170.3 million hectares of biotech crops were grown globally in 2012, up 10.3 million from 160 million hectares in 2011, with adoption growing three times faster in developing than in industrialized countries.

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Ht and Bt Crops

The most widely used GE crops incorporate gene coding for a glyphosate resistant enzyme from the bacteria *Agrobacterium tumefaciens*. This practice creates herbicide tolerant crops (or Ht crops) that can be sprayed with glyphosate without harm to the crop; glyphosate is commonly found in weed killing products such as Roundup. Farmers have adopted Ht crops because they offered less spraying, less traffic on the field, and lower operating costs. Ht crops allow farmers to practice no-till methods, thereby reducing soil erosion and runoff. Over time, monoculture methods, that use only these GE seeds and do not rotate crops, can create a field situation that is selective for the development of "superweeds" which are resistant to the herbicide. As a result, herbicide use, including more toxic herbicides, may increase. Because the databases on pesticide use are weak and researchers differ over the choice of analytical methods, there are contrasting results on pesticide trends and impacts in the literature for the US and globally even when the same time period is covered.

A naturally occurring bacterium, *Bacillus thuringiensis* (Bt), is often used by organic farmers as an insecticide because of its natural origin and low toxicity to humans and animals. When genetic material from Bt is introduced through genetic modification into certain plants, the plants become resistant to insect predation. Raising crops from such Bt plants results in increased yields and less money spent on post-planting applications of insecticide for many farmers. The rapid growth in reliance on Bt for insect control, following the introduction of GE crops, appears to be contributing to rootworm resistance to the Bt rootworm protection, while a second major corn pest targeted by a Bt trait—the corn borer—has not shown resistance. Although the threat of resistance can be reduced by good management practices, such as planting non-GE refuge crops, there is debate about the size of refuge areas needed and concern that recommended refuge practices are not always used or effective.

Potential Ancillary Concerns: Research on environmental impacts of Bt crops has focused on the possibility that beneficial insects or animals (e.g., bees and bats) will be harmed by ingesting the crops or pollen; while some studies have documented problems, others have found that the effect on non-target insects is minimal. Studies have also been conducted on the animal health impacts of consuming Ht and Bt products. While many studies have found no negative health impacts, there are some peer-reviewed studies that have identified problems in animals, leading their authors to call for more health impacts research and improvements in research methods.

The spread of Ht and Bt crops has raised concern about exposure to GE pollen contamination of non-GE crops. Alfalfa pollen can be carried as far as five miles by wind drift or movement of bees; GE sugar beet pollen can cross pollinate not only non-GE sugar beets, but also Swiss chard and table beets. There are two potential problems for farmers: (1) the possibility that unintended genetic modification may result in loss of income because farmers cannot sell contaminated products in their target market at the higher prices usually offered for non-GE products, and (2) the possibility that a manufacturer would sue a farmer whose crop was unintentionally contaminated. The latter issue has been partially resolved with Monsanto pledging not to prosecute unintended contaminations. The question of compensation is being dealt with by a few pending lawsuits seeking manufacturer compensation for past or potential income losses and by specialists in agricultural law. The specialists are evaluating the various legal options for facilitating the co-existence of GE and non-GE farms. A USDA Advisory Committee on Biotechnology and 21st Century Agriculture issued a report on enhancing co-existence in November of 2012.

Approval Process: The approval processes used by various agencies (FDA, USDA, EPA) varies, yet they all aim at providing risk assessment to eliminate or minimize potential harmful consequences. Before a transgenic crop can be grown outside a laboratory, it must receive Animal and Plant Health Inspection Service **(**APHIS) approval. The existing notification, permitting, and deregulation procedures are discussed in the GMO Overview on the LWVUS website. Post deregulation monitoring has been recommended in some studies.

Regulation in Foods: Regulation of GMOs is based upon the concept of *substantial equivalence,* wherein products are evaluated by regulatory agencies in a manner that compares them to conventional (non-GM) products or processes.

> *If a new food is determined to be substantially equivalent in composition and nutritional characteristics to an existing food, it can be regarded as being as safe as the conventional food (FDA, 1992; Kuiper et al., 2001; Maryanski, 1995; OECD, 1993) and does not require extensive safety testing. The evaluation of substantial equivalence includes consideration of the characteristics of the transgene and its likely effects*

> *within the host, as well as measurements of protein, fat and starch content, amino acid composition, vitamin and mineral equivalency, along with levels of known allergens and other potentially toxic components*

Although the concept of substantial equivalence is a starting point for the safety assessment for GM foods that is widely used by national and international agencies - including the Canadian Food Inspection Agency, Japan's Ministry of Health and Welfare and the U.S. Food and Drug Administration, the United Nation's Food and Agriculture Organization, the World Health Organization and the Organization for Economic Co-operation and Development (OECD), some scientists and organizations object to the concept. A much quoted discussion, published in Nature in 1999 asserts:

The concept of substantial equivalence has never been properly defined; the degree of difference between a natural food and its GM alternative before its 'substance' ceases to be acceptably 'equivalent' is not defined anywhere, nor has an exact definition been agreed by legislators. It is exactly this vagueness that makes the concept useful to industry but unacceptable to the consumer.

Public Views on the GMO Regulatory Processes and Findings

Public views on the health and environmental safety of GE products marketed in the US and the adequacy of the regulatory framework come from peer-reviewed journal articles and the popular press. Critics of the review process maintain that participation is voluntary, testing is conducted by the applicants as opposed to the agencies themselves, and responsibility for safety rests, in most cases, with the individual developers. Developers believe that the process is really mandatory (though labeled "voluntary"), rigorous, highly prescribed, and data generation is both time consuming and costly, with an average price per approval of $136 million over 13.1 years. The reasons for the differing points of view are well explained in a recent Grist.org blog, which concludes, surprisingly, that both sides are correct.

A recent review of the GE literature by Nicolia et al. concluded that the majority of peer-reviewed papers do not indicate a health risk for animals or humans consuming GE products or provide evidence of environmental hazards. Also, official statements by regulatory agencies in many countries and organizations with acknowledged scientific credentials (e.g., The US National Academies, the American Medical Association, the World Health Organization, the Royal Society, the European Commission, and Center for Science in the Public Interest) all agree that there is no evidence that it is dangerous to eat genetically modified foods. Recently, science-oriented publications including *Nature* and *Scientific American* also concluded there is no evidence that GMOs are harmful to us. The statements concerning the absence of evidence that GE foods pose health risks, however, are generally accompanied by calls for continued vigilance because it is impossible to prove anything absolutely safe.

Despite the above assurances of safety and statements such as "Several *trillion* meals containing genetically engineered food ingredients have been consumed by people around the world, with not a single adverse effect documented," concerns continue to be raised about GE risk assessment. In response to discussions in the popular press about a growing consensus among scientists on GE safety, 97 scientists have published a statement to say that such a consensus does not exist. Epidemiologists point out, for example, that it is difficult to actually study the link between GMOs and adverse effects in the US due to the absence of GMO product labeling, as this means that "…people don't know whether they've actually consumed [GMOs]." Others point to weaknesses in individual studies, while some have described perceived flaws in assessment protocols, and yet others have critiqued those having critiqued. Others mention knowledge gaps in scientists' understanding of gene sequencing and interrelationships and their understanding of how genetic expression is turned on and off; this has led to research on methods for assessing the risk from complex exposures that might include GE foods, animal antibiotics and hormones, pesticide residues, nanomaterials, and novel food processing materials in addition to a myriad of other factors.

Genetically Engineered Animals

The first GE application in animals took place in 1974, when viral DNA was inserted into a mouse embryo to create a transgenic mouse. GE mice have since been used for research on human disease and pharmaceutical testing. While more than 40 different breeds of animals have been genetically engineered, for research and medical purposes, as of yet, none have been approved for market release as human food. Traits being developed include "improved milk production and composition, increased growth rate, improved feed utilization, improved carcass composition, increased disease resistance, and enhanced reproductive performance." In 2008, the FDA provided guidelines for the regulation of

transgenic animals, premising the rules on the agency's authority to regulate new drugs. More information on the guidelines is available in the GMO Overview on the LWVUS website.

Regulatory hurdles and consumer acceptance of GE animals in the food chain have also discouraged research and development investment (e.g., the case of the Enviropig™), but rapidly declining stocks of fish worldwide have spurred significant research on GE fish such as AquaBounty's salmon, which grows twice as fast as wild salmon as a result of inserting genes from other fish. AquaBounty's salmon have been slowly nearing FDA approval after more than two decades of research and an investment of over $60 million. Consumer groups, including Consumers Union and Food &Water Watch however, have petitioned the FDA to assess the GE fish as a food additive, rather than an animal drug, and have expressed concerns about the transparency of the review process and the adequacy of the analysis of health impacts. The FDA responded to some of these concerns by arranging an open meeting and providing more data and information about the decision process. There has also been some discussion of potential environmental impacts if the GE fish escape and mate with wild fish. Scientific studies show that mating between transgenic and wild fish is possible, just as it is with non-GE farmed fish. The FDA appears satisfied with evidence presented by AquaBounty showing that this would not pose a significant problem given current production locations and methods.

U.S. seafood consumption has increased 50% since 1950 and has remained fairly consistent the past few years (finfish consumption is down, but shellfish consumption is up). According to National Oceanic and Atmospheric Administration (NOAA), about half of the seafood consumed in the United States is farmed, yet American aquaculture accounts for less than 5% of that consumption. Eighty-six percent of our seafood is imported. In light of these consumption and availability patterns, multiple steps have been taken towards expansion of U.S. marine aquaculture. See more about aquaculture in the Overview of Animal Management on the LWVUS website.

ANIMAL PRODUCTION

In the past two decades, four important trends have emerged in the livestock sector: (1) growth and concentration; (2) shifting geographic location; (3) increasing scale; and (4) the movement of meat processing from urban centers to rural communities.

Consolidation

Following World War II, increased grain yields, improvements in refrigeration and expanded transportation options made possible the growth of intensive animal feed operations. In 1935, 5.1 % of the nation's 42.8 million beef cattle were being fattened in feedlots, where cattle spend the last 90-120 days before slaughter rapidly putting on weight by consuming a grain-intensive diet. By 1963, that number had jumped to 66 %. By the end of the century, almost all cattle were being fattened on feedlots. While feedlots with less than 1,000 head of cattle are still in the majority, they "finish" only a small percentage of cattle production. Lots with 1,000 head or more finish 80 to 90 % of US cattle, and of those the few feedlots with 32,000 head or more account for around 40 % of the cattle production.

Even greater consolidation has taken place in the dairy sector. In 1940, 76.4 % of all US farms included cows for milking. As of 1997, that number was down to just 6.1 %. While the number of cows kept primarily for milking dropped from around 24 million in 1940 to about 9 million in 2000, milk production rose steadily as a result of more efficient milking technology, advances in animal nutrition and health, as well as biotechnological interventions in breeding and pharmacology (discussed in the Overview of Animal Management on the LWVUS website). Similar consolidation has taken place in the management of hogs and of poultry. According to the General Accountability Office (GAO), there were about 3,600 large-scale poultry and meat operations in the US in 1982. By 2002 that number had jumped to about 12,000.

Animal Feeding Operations (AFO)

According to EPA, an operation is an AFO if animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. CAFOs (concentrated animal feeding operations) are more narrowly defined as AFOs "with potential to impact water supply, either as a result of size (number of head of animals housed at any given time) and/or impact on proximate surface water." The EPA estimates that there are about 450,000 AFOs in the US, with about 15% of those designated as CAFOs.

Production efficiencies realized in concentrated animal systems have increased the national supply of inexpensive, readily available meat. Efficiencies of scale, capital-intensive new technologies for breeding, feeding, and processing; pressure from global competition; and consumer demand for uniform, convenient, inexpensive meat products all point to the continuing need for concentrated, consolidated animal management. Biogas experimentation suggests that aggregated animal waste could be an important new source of biofuel, potentially adding more economic incentive to further consolidation.

Feed for use in confined management systems is influenced by price and supply, which are in turn influenced by federal commodity subsidies. About 80% of US corn, 22% of US wheat, and 77% of global soy are used in animal feed each year. Ground fish meal provides protein: a third of the fish caught every year (31.5 million tons) are used in animal feed. A GAO report issued in September 2011 noted the necessary connection between antibiotic use and consolidated animal feeding. For more information on this see the Overview of Animal Management on the LWVUS website.

Of concern is the administration of antimicrobials to conventionally raised livestock in non-therapeutic doses for disease prevention. Many of the antibiotics used in animals are the same as those administered in humans. Others, like ionophores, have been developed for exclusive use in animals. Widespread use of antimicrobials in animal feed is linked to antibiotic resistant bacteria. According to the Animal Health Institute, which represents animal health drug sponsors, animal antibiotics make our food supply safer and people healthier. Antibiotics are a critical tool to prevent, control and treat disease in animals. In doing so, they also reduce the chance of bacterial transmission from animals to humans.

According to the FDA, the approval process involves evaluation of research conducted by the drug's sponsor, including a review for (1) safety to the animal and food products made from the treated animal, (2) effectiveness, (3) impact on the environment, and (4) safety of the people administering the drug or who may come into contact with the drug. To prevent drug residues in animal-derived foods from entering the food supply, FDA approval specifies a "withdrawal time", i.e. a waiting period following administration of a drug to when the animal may be slaughtered or when milk may enter the food supply.

Questions have been raised about the impact of CAFOs on local communities. A report funded by the National Association of Local Boards of Health found significant impacts on surface water (rivers, ponds, lakes), including "pathogens… growth hormones, antibiotics, chemicals used as additives to the manure or to clean equipment, animal blood, silage leachate from corn feed, or copper sulfate used in footbaths for cows." The same study documented concerns about noxious odors, dramatic increases in air-borne insects (primarily flies and mosquitoes), as well as the health impacts of CAFO air pollutants.

A corresponding concern for small and mid-size farmers is the loss of open, competitive markets ("spot markets") for independent growers. Farm coalitions have asked for passage of a Livestock Marketing Fairness Act, and would like to see legislation prohibiting packer-owned livestock. Farmers are also interested in seeing increased support for local food hubs and continuing expansion of farm cooperatives.

Indirect and Direct Subsidy of Concentrated Animal Feeding Operations

In 2007, researchers at Tufts Institute reviewed the impact of Farm Bill commodity subsidies (see Subsidies and Crop Insurance) on the economic structure of animal management. Their conclusion was that federal subsidies on corn and soy guaranteed below-cost feed, making purchase of feed less expensive than growing feed on-site or maintaining adequate pasture. In effect, subsidies of industrial feed saved large scale farms "an estimated $3.9 billion per year . . . a reduction amounting to 5%-15% of operating costs."

> *The implicit subsidy to industrial feed has contributed to the consolidation of factory hog operations. With a 15% discount on operating costs compared to hog farmers who grew their own feed crops, factory farms enjoyed a competitive advantage that did not come simply from their economies of size. Using cost data from the U.S. Department of Agriculture and other published sources, we estimate that mid-sized diversified farms – those with 500-2,000 hogs fed largely by on-farm crops – would have comparable production costs to those of industrial producers if the latter had to pay full cost for their feed.*

CAFOs receive a more direct subsidy through Environmental Quality Incentives Program (EQIP) funding. Through EQIP, farmers can apply for financial and technical assistance "to help plan and implement conservation practices that address

natural resource concerns." Introduced in the 1996 Farm Bill, EQIP originally targeted small and mid-size farms. In 2002, the program was reauthorized with greatly expanded funding and removal of the restrictions on large-scale waste management systems. The National Sustainable Farm Associations has petitioned for greater transparency regarding disbursement of EQIP funds, economic and environmental analysis of the impact of EQIP contracts, lower caps with no "special exceptions," and restriction of EQIP funds to mitigation of existing environmental challenges, rather than financing waste management operations of new or expanding CAFOs.

EPA Regulation of CAFOs

In 2008, the GAO issued a report noting EPA's inability to gather adequate information about CAFO size, location, and waste management strategies, as well as its failure to assess the impact of CAFO pollutants on the environment or human health. Operations that meet CAFO size thresholds are only registered for National Pollutant Discharge Elimination System (NPDES) permits if they voluntarily acknowledge waste discharges. Therefore, the majority of facilities are not regulated under EPA rules, although they may be subject to widely varying state laws. In 2009, an EPA working group found that, since only a small percentage of CAFOs seek permits to discharge, EPA oversight of feeding operations was limited. The taskforce recommended that EPA lower the regulatory threshold for AFOs, set a threshold for multiple AFOs in impaired watersheds, begin "a comprehensive data collection plan" to provide information on all CAFOs and their waste management plans, and "inspect more AFOs to determine which might be significant contributors of nutrient pollution to waters." Such regulation was introduced in 2011, but withdrawn in 2012 following strong opposition from the National Association of State Departments of Agriculture and other groups. See more information on the LWVUS website.

NANOTECHNOLOGY

Nanotechnology is defined by the Royal Society/Royal Academy of Engineering Working Group as follows: "Nanoscience is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at larger scale. Nanotechnologies are the design, characterization, production and application of structures, devices and systems by controlling shape and size at nanometre scale." Nanotechnology is a process that builds, controls and restructures materials that are the size of atoms and molecules. A nanometer (nm) is one-billionth of a meter. (In a more familiar frame of reference, a sheet of paper is about 100,000 nanometers thick.)

As of 2013, over 1600 commercially available products contain nanomaterials. Some examples of newly developed products include a stain repellent in clothing, material to extract toxins from water, sunscreens to absorb light, and a barrier in packaging such as beer bottles (producing a lighter weight bottle with longer shelf life).

Research is underway for a variety of future uses in agriculture production such as 1) precision farming–acting as sensors that are distributed in the field and linked through GPS to detect soil conditions, insects or presence of disease; 2) smart delivery systems, delivering chemicals in a controlled, targeted manner, to address a problem such as disease, nutrient deficiency, or insects even before the farmer can visually detect a problem; and 3) water filtration. Researchers report that "so-called multi-walled carbon nanotubes" can penetrate through the thick coatings on seeds, stimulate germination of the seeds and stimulate the growth of certain plants.

Safety Concerns

There is agreement that this technology may be important in the future; however, with the rapid expansion of research and development (R&D) of new uses, questions as to safety and potential toxicity from these products need to be addressed as soon as possible. The risks include the ability of the particles to cross the blood-brain, dermal, placental and other barriers, potential impacts on biological systems and control and tracking of the particles. For example a recent study from the University of Missouri indicates that silver particles used as a pesticide in the treatment of pears, can be retained on the pear surface and penetrate into the pulp, and could potentially be taken into the human body. Whether or not these could be toxic is not yet known. Other concerns include effects in the environment on soil organisms and insects. Both industry and the public are seeking to have rules and guidance to address health and safety concerns.

The National Nanotechnology Initiative (NNI) is a collaborative, multi-agency, cross-cutting program among 25 federal agencies, 15 of which have specific nanotechnology budgets: R&D funds for research to advance understanding and control of matter at nanoscale with a goal of "national economic benefit, national and homeland security, improved

quality of life." The NNI's 2010 research budget totaled an estimated $1.78 billion. About 5% of that was devoted to environmental, health, and safety research, with the rest going toward basic research into nanomaterial behavior, research facilities, and developing nanoscale devices and systems. Through this initiative governmental organizations have combined funding and are exchanging information. The EPA is in the process of developing rules and guidance.

For more information on this and other technologies see the Overview of Nano and Other Technologies on the LWVUS website.

AGRICULTURE UPDATE CONSENSUS QUESTIONS

I Economic Health of the Agricultural Sector

1. Should government financial support for agriculture be directed to:
   a) Subsidized agricultural credit (loans)
   b) Disaster assistance
   c) Crop insurance
   d) Farms that supply local and regional markets
   e) Subsidized implementation of best management practices
   f) Commodity crop programs, e.g., corn, soybeans, sugar, cotton, wheat
   g) Commodity livestock program
   h) Commodity dairy program
   i) Specialty crops, e.g. fruits, vegetables, nuts, etc.
   j) Other production methods, e.g. organic, hydroponic, urban, etc. farms
2. What changes should government make regarding **direct payment programs** to farm operators? Note: Farm operators can be anything between family farms to huge corporations.
   a) *Eliminate* direct payments to farm operators
   b) *Update* the rules for direct payments to farm operators to support sustainability
   c) *Broaden* the types of farms that are eligible
   d) *Broaden* the types of crops that are eligible
   e) Effectively *enforce* existing rules
3. What changes to current crop insurance programs should government make?
   a) Extend to more types of crops
   b) Link to the use of conservation practices
   c) Limit insurance for the cultivation of marginal and environmentally sensitive land
   d) Cap amount of premium subsidy to a single farm operator (see note in question 2)
4. Should government act on any of the following?
   a) Revise anti-trust legislation to ensure competitive agricultural markets
   b) Enforce anti-trust laws as they relate to agriculture
   c) Promote alternative marketing systems, including regional hub markets, farmer cooperatives, farm markets, etc.

II Animal Management

5. Which of the following approaches to animal management should government achieve?
   a) Transparently collect and disclose data about regulated animal feeding operations (AFOs) or aquaculture operations and about the health of animals in such regulated operations
   b) Apply and enforce existing clean air and clean water regulations to animal or seafood management facilities
6. Which of the following approaches to animal waste management should government require or bring about?
   a) Treat animal waste with environmentally sound technologies for all regulated AFOs
   b) Prioritize federal funds to mitigate existing environmental challenges (such as Environmental Quality Incentives Program, cost share, loans, etc.) rather than construction of new facilities

III Research and Development

7. Which of the following approaches to research and development (R&D) should government fund or accomplish? Note: For the purpose of these questions and some questions below, **"developed using any new technology"** or **"new technologies"** refer to any of many scientific processes for developing new crops or animals with genetic engineering, nanotechnology or other new techniques, which are not the traditional breeding or hybridization techniques.

a) Basic research
b) Independent third-party (such as an academic institution) risk assessment of products *developed using any new technology*
c) Research to assess the impacts of *new technologies* on human health and the environment, prior to their widespread adoption
d) Research that advances the continuation of diversified and sustainable agricultural systems
e) Seed banking, research, and other means that promote and preserve genetic diversity
f) Both transparency in the reporting of research studies related to approval of new products **and** respect for intellectual property rights of private enterprises engaged in research
g) Research on long-term effects of new crops, products and processes
h) Development of new practices and technologies to promote conservation for all types of farms

IV Food Safety

8. Which of the following approaches to food safety should government perform or fund?
   a) Clarify and enforce pre-market testing requirements for new foods and food additives *developed using any new technology* (see note below question 7)
   b) Require developers to monitor all food products *developed using any new technology* after releasing to the market
   c) Withdraw marketing approval if products are shown to be unsafe
   d) Require post-market monitoring of approved pharmaceutical applications in animal production for human health and environmental impacts
   e) Require developers of new products to provide data and other materials to independent third-parties (such as academic institutions) for pre- and post-market safety assessment as appropriate
   f) Limit use of antibiotics in animal production to treat and control disease
   g) Fund independent third-party (such as academic institutions) risk assessment of long-term and multiple exposures from foods on human health and the environment
   h) Promote crop management practices that decrease dependency on added chemicals (pesticides, herbicides, and synthetic fertilizers)
   i) Fund, train and add personnel for assessment and compliance functions of regulatory agencies

V Food Labeling

9. How sufficient are the following regarding current food labeling?
   a) Nutrition Facts on food labels
   b) Nutrition Facts on food labels as a means of consumer education
   c) Common allergen labeling
   d) Health and ingredient claims that consumers can understand
10. Which of the following should government achieve regarding marketing and ingredient claims on food labels?
   a) Define (and approve for use) health and safety marketing terms (e.g. immunity support, humane, pasture-raised, natural, etc.)
   b) Regulate the use of images or other sensory advertising
   c) Require that ingredient marketing claims accurately represent what is in the required ingredient list
11. Recognizing that each food developed using any new technology can be unique, and assuming that required food labeling should be useful to consumers, should the following generalized information relating to how products or components are developed be presented on food labels?
See note below question 7. All these questions also assume some percentage threshold of new technology ingredients, such as the 0.9% used in the European Union.
   a) Contains ingredients developed using any new technology stating which technologies are involved
   b) Does **not** contain ingredients developed using any new technology
   c) If meat, fish, eggs, or dairy products are from animals that have consumed feed developed using any new technology stating which technologies are involved

This Fact Sheet was prepared by the LWVMC based upon research conducted for the LWVUS Agricultural Update. The LWVMC committee is: Margaret Chasson, Chair; Elaine Apter, Maxine Montgomery, Judy Morenoff, Lorna Post, Alyce Ortuzar and Marilyn Smith.