

## Food Safety Unit Plan

Unit Name:	Food Safety
Estimated Time:	1 Week
Essential Questions:	<ol style="list-style-type: none"> <li>1. Why are consumers concerned with food safety?</li> <li>2. How is food safety impacted by agricultural production practices?</li> <li>3. How can the animal and food industries improve food safety?</li> </ol>
Essential Question 1: Why are consumers concerned with food safety?	
Agriscience Foundations I Standards:	<p>3.08 – Evaluate advances in biotechnology that impact agriculture (e.g. transgenic crops, biological controls, etc.).</p> <p>1.04 – Examine the role of the agricultural industry in the interaction of population, food, energy, and the environment.</p> <p>3.06 – Interpret, analyze, and report data.</p>
Objectives:	<p>Students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify biotechnological innovations that have impacted the food supply.</li> <li>2. Evaluate the potential benefits and drawbacks of advancements in biotechnology.</li> <li>3. Identify historical events that have led consumers to elicit concern regarding food safety.</li> </ol>
Objective 1:	Identify biotechnological innovations that have impacted the food supply.
Content Outline:	<ol style="list-style-type: none"> <li>1. Terminology             <ol style="list-style-type: none"> <li>a. Biotechnology – using organisms and their components to make products (includes GMOs)</li> <li>b. Genetically modified foods – alters the genetic makeup of organisms (plants, animals, bacteria). AKA genetically engineered, transgenic</li> </ol> </li> <li>2. Food biotechnology’s current status:             <ol style="list-style-type: none"> <li>a. Hybrid plant varieties became commercially available in 1930s, and greatly increased crop yields</li> <li>b. The creation of the first genetically engineered farm animals was documented in 1985</li> <li>c. In 2006, 252 million acres of transgenic crops were planted in 22 countries                 <ol style="list-style-type: none"> <li>i. 53% was in the US</li> </ol> </li> <li>d. In 2009, over 330 million acres of biotech crops were grown</li> <li>e. The first medical product from a genetically engineered animal was approved by US govt. in 2009</li> <li>f. The practical benefits of this technology have not yet reached American patients and consumers, however continued successful application of the new United States (U. S.) federal government regulatory process should be aggressive, enabling scientific innovation.</li> </ol> </li> <li>3. Goals of food biotechnology’s innovations:             <ol style="list-style-type: none"> <li>a. Overcome agricultural limitations                 <ol style="list-style-type: none"> <li>i. Salt tolerant plants                     <ol style="list-style-type: none"> <li>1. Used to grow crops on land with water that has high salt content (otherwise would be nonproductive)</li> </ol> </li> <li>ii. Increase in milk production in dairy cows                     <ol style="list-style-type: none"> <li>1. Uses bST hormone that cows naturally produce, inject more bST into the cow to produce more milk</li> </ol> </li> <li>iii. Increase growth rates with hormones in cattle, fish, pigs, sheep</li> <li>iv. Fruit and nut trees that yield years earlier than they do naturally</li> <li>v. Drought or flood resistant crops</li> </ol> </li> </ol> </li> </ol>

	<ul style="list-style-type: none"> <li>b. Increase food quality <ul style="list-style-type: none"> <li>i. Shelf life <ul style="list-style-type: none"> <li>1. Flavr Savr tomato</li> </ul> </li> <li>ii. Pest resistance <ul style="list-style-type: none"> <li>1. Corn</li> <li>2. Soybeans</li> <li>3. Cotton</li> <li>4. Canola</li> <li>5. Alfalfa</li> </ul> </li> <li>iii. Disease resistance <ul style="list-style-type: none"> <li>1. In cattle (mad cow disease [BSE], chickens, fish, pigs)</li> <li>2. Sweet potatoes that are resistant to a virus that could kill most of Africa’s harvest</li> </ul> </li> <li>iv. Taste <ul style="list-style-type: none"> <li>1. Increase meat tenderness with product that knocks out acid-meat gene</li> </ul> </li> </ul> </li> <li>c. Improve human health <ul style="list-style-type: none"> <li>i. Disease management <ul style="list-style-type: none"> <li>1. Lactose fortified milk</li> </ul> </li> <li>ii. Disease prevention <ul style="list-style-type: none"> <li>1. Fortified milk</li> <li>2. Reduce “bad” fats and increase “good” fats of plant oils (like Omega-3 fatty acids)</li> <li>3. Reduce fat and cholesterol in meat of cattle and pigs</li> <li>4. Rice with increased iron and vitamins (Golden rice has beta carotene, which is Vitamin A)</li> <li>5. Bananas that produce human vaccines against diseases like hepatitis B</li> </ul> </li> </ul> </li> <li>d. Minimize environmental impact <ul style="list-style-type: none"> <li>i. Reduce waste excreted by enhancing growth rate of fish, cattle, and pigs</li> <li>ii. Detect pollutants more easily with use of GloFish</li> <li>iii. Increase nitrogen use efficiency to require less nitrogen fertilizer</li> <li>iv. Enviropig – line of Yorkshire pig that is able to digest phosphorus in grains, which keeps the amount of phosphorus in manure lower</li> <li>v. Goat with spider silk – use less natural resources for building</li> </ul> </li> </ul>
Objective 2:	Evaluate the potential benefits and drawbacks of advancements in biotechnology.
Content Outline:	<ul style="list-style-type: none"> <li>1. Food Quality <ul style="list-style-type: none"> <li>a. BENEFIT – enhanced taste and quality <ul style="list-style-type: none"> <li>i. Longer shelf life, better coloring, less disease, improved marbling</li> </ul> </li> </ul> </li> <li>2. Food Safety <ul style="list-style-type: none"> <li>a. BENEFIT – foodborne diseases are a major global contributor to human death and illness <ul style="list-style-type: none"> <li>i. Could produce foods that are resistant to food borne pathogens (E.coli, salmonella, ect.)</li> <li>ii. Could reduce animals’ ability to contract zoonotic diseases (those passed between animals and humans)</li> </ul> </li> <li>b. DRAWBACK – new regulations that do not have an established successful history <ul style="list-style-type: none"> <li>i. GMO labeling is currently not mandatory in some countries (like the US)</li> </ul> </li> <li>c. DRAWBACK - bioterrorism</li> </ul> </li> <li>3. Economic Impacts <ul style="list-style-type: none"> <li>a. BENEFIT – cheaper, more available foods <ul style="list-style-type: none"> <li>i. Fewer costs to produce foods because of less fertilizer, pesticides, supplemental dietary additives, feed, water, and medical care. Also, more food is available, increasing supply leads to cheaper foods</li> </ul> </li> <li>b. DRAWBACK – domination of world food production by a few companies</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>i. Increased dependence on certain nations with reduced food independence</li> <li>4. Environmental Impacts <ul style="list-style-type: none"> <li>a. BENEFIT – agricultural industries have been targeted by some as being harmful to the environment due to use of pesticides, fertilizers, and causing increased water, land, and air pollution. GMOs can reduce fertilizer and pesticide usage, increase animal and plant efficiency in their use of certain nutrients, and reduce animal wastes</li> <li>b. BENEFIT – higher yielding animals and plants will reduce the burden on limited land and water resources</li> <li>c. DRAWBACK – unknown effects on other organisms <ul style="list-style-type: none"> <li>i. Can impact entire ecosystems in ways we don’t yet know</li> <li>ii. Unintended transfer of genes through accidental cross-pollination</li> </ul> </li> </ul> </li> <li>5. Human Health <ul style="list-style-type: none"> <li>a. BENEFIT - Could greatly reduce diseases that result from poor diet of high fats and low quality protein (cardiovascular disease, cancers, diabetes, obesity) <ul style="list-style-type: none"> <li>i. Health and cognitive skills improve with increased nutrition <ul style="list-style-type: none"> <li>1. A limited land supply means agriculturalists must develop more nutritional foods on the same amount of land, since they can’t simply produce more food on more land</li> </ul> </li> <li>ii. Childhood obesity is a nationwide epidemic <ul style="list-style-type: none"> <li>1. Leaner meats and oils with “good” fats and fewer “bad” fats can decrease obesity</li> </ul> </li> </ul> </li> <li>b. DRAWBACK – unknown effects of GMOs on human health <ul style="list-style-type: none"> <li>i. Allergies, transfer of antibiotic resistance to humans, etc.</li> </ul> </li> </ul> </li> <li>6. Plant and Animal Industry <ul style="list-style-type: none"> <li>a. BENEFIT – fewer resources (feed, land, etc.) will be needed to produce more food <ul style="list-style-type: none"> <li>i. Animals with greater feed efficiency and better quality/more meat production on less food and with fewer supplements</li> <li>ii. Plants yield more on same amount of land with less water and fertilizer and in more varied weather and soil conditions</li> <li>iii. Improved reproductive performance can yield more offspring with desirable traits through fewer breedings</li> </ul> </li> <li>b. DRAWBACK – smaller farmers may get pushed out of industry by more powerful companies</li> <li>c. DRAWBACK – unknown long term effects of gene manipulation on breeds and species <ul style="list-style-type: none"> <li>i. Reduction of genetic variety in a species</li> </ul> </li> </ul> </li> <li>7. Animal Welfare <ul style="list-style-type: none"> <li>a. BENEFIT – Can reduce animals’ susceptibility to disease and illness – mad cow disease, mastitis, foot and mouth disease, etc., which will decrease animal stress and suffering <ul style="list-style-type: none"> <li>i. Will reduce need for medical treatments and use of antibiotics</li> </ul> </li> <li>b. DRAWBACK – could cause unknown stress for animals</li> </ul> </li> <li>8. Ethics <ul style="list-style-type: none"> <li>a. BENEFIT – improvement of global human health and reduction of human death, disease, poverty, and hunger</li> <li>b. DRAWBACK – tampering with nature by mixing genes among species <ul style="list-style-type: none"> <li>i. Some people may be opposed to eating the genes of animals in plant foods, vice versa</li> </ul> </li> </ul> </li> </ul>
Objective 3:	Identify historical events that have led consumers to elicit concern regarding food safety.
Content Outline:	<ul style="list-style-type: none"> <li>1. Beef <ul style="list-style-type: none"> <li>a. E. coli <ul style="list-style-type: none"> <li>i. 2005 – 5 beef recalls related to E. coli</li> <li>ii. 2006 – 8 recalls</li> <li>iii. 2007 – 21 recalls</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>b. Mad Cow Disease (Bovine Spongiform Encephalopathy) <ul style="list-style-type: none"> <li>i. Largest beef recall in US history in 2008 (143 million lbs) after videos of down cows going to slaughter were released by Humane Society of U.S.</li> <li>ii.</li> </ul> </li> <li>c. Foot and Mouth Disease <ul style="list-style-type: none"> <li>i. First outbreak in Britain in over 20 years was in 2001, led to ban of all British exports of meat, livestock, and milk. 7 million sheep and cattle were killed to stop disease spread</li> </ul> </li> <li>d. Hormone additive controversy</li> </ul> <p>2. Swine</p> <ul style="list-style-type: none"> <li>a. H1N1 <ul style="list-style-type: none"> <li>i. Outbreak in 2009 US show swine and humans caused some countries (China, Russia, Ukraine) to ban pork coming from Mexico and US, and Egypt to slaughter 300,000 pigs, although swine flu is not spread through eating infected pork. Confusion led World Health Organization to stop using the term “swine flu”.</li> </ul> </li> </ul> <p>3. Poultry</p> <ul style="list-style-type: none"> <li>a. Avian Influenza <ul style="list-style-type: none"> <li>i. First reported in animals and humans (some died) in 1997 in Hong Kong. Spread through Asian countries’ poultry and humans on a sporadic basis, then moves to Europe in 2006. US sees first cases in wild birds in 2006. Live poultry markets are permanently closed in Beijing and China</li> </ul> </li> </ul> <p>4. Lettuce</p> <ul style="list-style-type: none"> <li>a. Bagged salad was linked to E. coli outbreaks in 2006, 2010, and 2011</li> </ul> <p>5. Peanut Butter</p> <ul style="list-style-type: none"> <li>a. 2007 outbreak of Salmonella in Peter Pan and Great Value peanut butters</li> <li>b. 2009 outbreak of Salmonella in King Nut peanut products</li> </ul> <p>6. Sprouts</p> <ul style="list-style-type: none"> <li>a. E. coli outbreak Germany in May 2011, killed 49, over 800 developed life threatening kidney complication. Contaminated seeds from Egypt are thought to be the cause.</li> </ul>
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Essential Question 2: How is food safety impacted by agricultural production practices?

Agriscience Foundations I Standards:	<p>2.03 – Evaluate the food safety responsibilities that occur along the food supply chain.</p> <p>6.05 – Demonstrate scientific practices in the management, health, safety, and technology of the animal agriculture industry.</p> <p>4.04 – Identify regulatory agencies that impact agricultural practices.</p>
Objectives:	<p>Students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify agricultural organizations’ roles in the production of a safe food supply.</li> <li>2. Analyze the impact of current agricultural practices on food safety.</li> </ol>
Objective 1:	<p>Identify agricultural organizations’ roles in the production of a safe food supply.</p>
Content Outline:	<ol style="list-style-type: none"> <li>1. USDA – <ul style="list-style-type: none"> <li>a. The <b>Agricultural Marketing Service (AMS)</b> - administers plant variety and seed laws, including GM seeds, and administers laws for certification and labeling of seeds for trade. AMS also offers laboratory testing services for GM foods and fiber products and <i>voluntary</i> process verification services to assure separation of GM and conventional products in food chain.</li> <li>b. The <b>Agricultural Research Service (ARS)</b> conducts research in new traits and improving existing traits in livestock, crops, and microorganisms; safeguarding the</li> </ul> </li> </ol>

environment; and assessing and enhancing the safety of biotechnology products. ARS also develops and provides access to agricultural resources and genomic information.

- c. The **Animal and Plant Health Inspection Service (APHIS)** regulates field-testing, interstate movement, and importation of GMOs. APHIS determines whether a GMO is as safe for the environment as its traditionally bred counterpart and can be freely used in agriculture.
- d. The **Economic Research Service (ERS)** conducts research on the economic aspects of the use of GMOs, including the rate of and reasons for adoption of biotechnology by farmers. ERS also addresses economic issues related to the marketing, labeling, and trading of GMOs.
- e. The **Food Safety and Inspection Service (FSIS)** is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged including animals involved in biotechnology.
- f. USDA's **Foreign Agricultural Service (FAS)** supports the overseas acceptance of biotechnology and crops that have been reviewed by the U.S. government agencies to support U.S. farm exports and promote global food security.
- g. The **Grain Inspection, Packers and Stockyards Administration (GIPSA)** provides inspection, weighing, and related services on grains, pulses, oilseeds, and processed and graded commodities. GIPSA also oversees a *voluntary* process verification program which allows suppliers to assure customers about the quality of their products or services through independent audits of their manufacturing practices or services.
- h. The **National Agricultural Statistics Service (NASS)**, as the fact finder for agriculture, provides information on the adoption of biotechnology crops (specifically corn, cotton, and soybeans). NASS has been tracking the adoption of biotech crops since 2000.
- i. The **National Institute of Food and Agriculture (NIFA)** provides funding and program leadership for research in agricultural biotechnology. Also supports the development of science-based information regarding the safety of introducing into the environment genetically-modified plants, animals, and microorganisms.

## 2. FDA

- a. FDA is the federal agency responsible for ensuring that foods are safe, wholesome and sanitary; human and veterinary drugs, biological products, and medical devices are safe and effective; cosmetics are safe; and electronic products that emit radiation are safe. FDA also ensures that these products are honestly, accurately and informatively represented to the public. Some of the agency's specific responsibilities include:
  - i. Foods
    - 1. Labeling
    - 2. safety of all food products (except meat and poultry)
    - 3. bottled water
  - ii. Veterinary Products
    - 1. Livestock feeds
    - 2. Pet foods
    - 3. Veterinary drugs and devices
- b. Doesn't regulate alcohol, meat and poultry, pesticides

## 3. CDC

- a. Works with USDA and FDA to ensure food safety. Acts as agency that connects consumer illness with food production processes through:
  - i. Monitoring human illness and tracking illness occurrences
  - ii. Identifying the foods and settings linked with illness
  - iii. Investigating outbreaks and cases
  - iv. Working with state and local health departments
  - v. Targeting prevention measures to meet long-term food safety goals
  - vi. Informing food safety action and policy

	<p>4. EPA</p> <ol style="list-style-type: none"> <li>a. FDA, USDA, and the Environmental Protection Agency share the responsibility for regulating pesticides. EPA determines the safety and effectiveness of the chemicals and establishes tolerance levels for residues on feed crops, as well as for raw and processed foods.</li> </ol>
Objective 2:	Analyze the impact of current agricultural practices on food safety.
Content Outline:	<ol style="list-style-type: none"> <li>1. Beef Industry       <ol style="list-style-type: none"> <li>a. Calves are vaccinated, castrated, implanted, dehorned</li> <li>b. Cattle are given additives in feed           <ol style="list-style-type: none"> <li>i. Antimicrobial Drugs</li> <li>ii. Animals raised in confinement hold greater potential for spread of harmful microbes, so antimicrobial drugs keep these under control</li> <li>iii. Used at a lower level in the feed than if the animal was sick (subtherapeutic level)</li> <li>iv. Has been used less frequently recently because of concern about the development of resistant strains of bacteria</li> <li>v. Hormones</li> <li>vi. Normally produced in the body to regulate body functions (growth, metabolism, reproductive cycle, etc)</li> <li>vii. Hormones and synthetic hormones are added to stimulate certain functions</li> <li>viii. Synthetic hormones are approved by the FDA for use in beef cattle finishing rations               <ol style="list-style-type: none"> <li>a. DES was used as a synthetic estrogen to increase rate of gain in steers, but was banned in 1972 because of cancers in women when used to prevent miscarriages. Ban was lifted and then banned again by 1979.</li> <li>b. Cases like this continue to make use of hormones controversial</li> <li>c. Since 1989 European Union banned importation of any meat for human consumption that has been treated with hormones</li> <li>d. Problematic because it is not possible to differentiate between hormones injected and those produced by the animal</li> <li>e. In 1998, World Trade Organization ruled that EU ban was a violation of international trade rules, but studies showing harmful effects of one growth hormone keep the ban in effect.</li> </ol> </li> <li>ix. Dewormers – control parasites</li> </ol> </li> <li>c. Processing           <ol style="list-style-type: none"> <li>1. Feed additives and drugs are removed from feed for a specified amount of time before slaughter</li> <li>ii. Feed is adjusted to condition animals for travel</li> <li>iii. Cattle are moved slowly and quietly when loading and handling to keep animals relaxed and keep meat cuts high quality</li> <li>iv. Trucks are loaded without crowding or underloading to reduce animal injury</li> </ol> </li> <li>d. To increase food safety           <ol style="list-style-type: none"> <li>i. Producers encouraged to attend Beef Quality Assurance Training.</li> <li>ii. Irradiation of ground beef products is done by packers and meat retailers to kill bacteria (like E. coli)</li> <li>iii. Educational efforts encourage consumers to cook hamburger thoroughly, clean utensils and surfaces</li> <li>iv. It's illegal to sell animal products to cattle that may transmit the organism for mad cow disease</li> <li>v. Country of origin labeling</li> </ol> </li> </ol> </li> </ol>

- vi. Mandatory identification allow verification of origin of beef products
- 2. Swine Industry
  - a. Piglets
    - i. Umbilical cord cut, remaining cord sprayed with iodine
    - ii. Cut needle teeth (8 sharp teeth) – tips are removed at one day old to prevent cuts on other piglets and sow’s udder (reduces risk of infection)
    - iii. Some large commercial operations have abandoned this practice and experience few problems
    - iv. Tail docking at one day old - reduces chance of tail biting (older pigs fed in confinement may bite other pigs’ tails)
    - v. Ear notching – identification of individual pigs. More permanent than ear tags
    - vi. Receive dose of long-lasting antibiotic to ward off infection
    - vii. Receive iron injection at 7 days old b/c sow milk is low in iron (prevents anemia)
    - viii. Injections given on neck 1 inch behind ear to avoid abscesses or iron stain in ham muscle
    - ix. Boars are castrated at 3-7 days of age to reduce stress
  - b. To increase food safety
    - i. Welfare audits lead large eating establishments to pressure packers to verify that pork was raised under acceptable production conditions
    - ii. Packers require their producers to maintain Pork Quality Assurance certification from National Pork Board
      - 1. National Pork Board provides a voice for producers nationwide and develops promotional/educational materials
        - a. 15 producers are appointed by US Secretary of Ag.
    - iii. Producers follow 10 good production practices to ensure pork quality
    - iv. Producers practice biosecurity
    - v. 2002 Farm Bill – Congress mandated country of origin labeling
      - 1. National Pork Producers Council tracks legislative issues for pork producers
- 3. Poultry Industry
  - a. Animal Management
    - i. Raised in confinement in an open-floor system
    - ii. House is cleaned and disinfected each time a flock leaves, wait one week for new flock to come in
    - iii. Ventilation will prevent respiratory diseases and will reduce ammonia odor
    - iv. Chickens may be debeaked to prevent cannibalism (1/3 of upper beak and ¼ of lower beak is removed). Does not affect growth or health of chickens
    - v. Hormone implants may be used to produce same results as caponing (surgically castrating males). This causes chickens to produce more tender meat.
  - b. Processing
    - i. Should not be fed 12 hours before slaughter
    - ii. Avoid overcrowding in delivery coops
- 4. Dairy Industry
  - a. Animal Management
    - i. Feeding needs vary by cow status (pregnant, milking, dry, calf, bull)
    - ii. Vitamin and mineral supplementation varies by amount of feed, which varies on lactation period
    - iii. Forages are tested for nutritional quality every 60 days
  - b. Processing
    - i. Cow’s udders are washed to disinfect udder and trigger release of oxytocin,

	<p>which initiates milk letdown</p> <p>ii. Teats are dipped in iodine to prevent bacterial invasion of udder</p>
<p>Essential Question 3: How can the animal and food industries improve food safety?</p>	
<p>Agriscience Foundations I Standards:</p>	<p>2.03 – Evaluate the food safety responsibilities that occur along the food supply chain.</p> <p>6.05 – Demonstrate scientific practices in the management, health, safety, and technology of the animal agriculture industry.</p> <p>4.04 – Identify regulatory agencies that impact agricultural practices.</p>
<p>Objectives:</p>	<p>Students will be able to:</p> <ol style="list-style-type: none"> <li>1. Compare current agricultural practices and consumer concerns to determine areas of improvement for food safety.</li> <li>2. Evaluate the potential benefits and drawbacks of possible solutions to current food safety issues.</li> </ol>
<p>Objective 1:</p>	<p>Compare current agricultural practices and consumer concerns to determine areas of improvement for food safety.</p>
<p>Content Outline:</p>	<ol style="list-style-type: none"> <li>1. Food Quality <ol style="list-style-type: none"> <li>a. Public Concerns – inconsistency in product quality, cost versus quality, shelf life</li> <li>b. Current Solutions – <ol style="list-style-type: none"> <li>i. food additives – increase consistency in quality, but some are concerned with potential human health effects</li> <li>ii. preservatives – increases food shelf life, but some are concerned with potential human health effects</li> <li>iii. pesticides – increases consistency in quality, produces more attractive products, but some are concerned with potential human and environmental effects</li> <li>iv. organic choices – don’t contain pesticides, but are typically more expensive and less attractive (bug spots, ect.)</li> <li>v. GMOs – reduces use of pesticides and increases consistency in quality, but some are concerned with potential human and environmental effects</li> </ol> </li> </ol> </li> <li>2. Food Safety <ol style="list-style-type: none"> <li>a. Public Concerns – contamination through processing, allergens, lack of consistent regulation, bioterrorism, lack of knowledge of GMO impacts</li> <li>b. Current Solutions – <ol style="list-style-type: none"> <li>i. Current regulation and inspection standards by USDA, FDA, EPA, and CDC, and Department of Homeland Security</li> <li>ii. Buy locally – reduced processing, can be costly, reduces product availability</li> <li>iii. Organic choices – reduces food additives, can be costly</li> </ol> </li> </ol> </li> <li>3. Economic Impacts <ol style="list-style-type: none"> <li>a. Public Concerns – high cost of quality foods, world hunger</li> <li>b. Current Solutions – <ol style="list-style-type: none"> <li>i. Public assistance – available to purchase specific healthy foods to those below a certain income level</li> <li>ii. Food warehouses/Large store chains – can purchase more food for less cost, and pass savings to customer (Ex – food at Walmart is typically cheaper than at a convenience store or a local food store)</li> <li>iii. GMOs – can greatly reduce world hunger and the cost of food because of less cost input required to produce foods, but some countries won’t import GMOs due to health and safety concerns</li> </ol> </li> </ol> </li> <li>4. Environmental Impacts <ol style="list-style-type: none"> <li>a. Public Concerns – agriculture industry’s impact on water, soil, and air pollution, due to pesticide and manure runoff and resource usage</li> <li>b. Current Solutions – <ol style="list-style-type: none"> <li>i. Increased governmental regulation on pollution runoff and output levels</li> </ol> </li> </ol> </li> </ol>



	<ul style="list-style-type: none"> <li>ii. Organic farming – reduces use of pesticides</li> <li>iii. GMOs – reduces use of pesticides and waste produced by animals (increased feed efficiency and fewer animals with higher yields)</li> </ul> <p>5. Human Health</p> <ul style="list-style-type: none"> <li>a. Public Concerns – food safety recalls from foods infected with diseases, poor diets (high fat, low nutrition) lead to disease (diabetes, obesity, cardiovascular disease), increasing prevalence of food allergies among children</li> <li>b. Current Solutions – <ul style="list-style-type: none"> <li>i. Current food regulation and inspection by USDA, FDA, and CDC</li> <li>ii. Enriched and fortified foods contain nutrients not normally found in that product (Iodized salt, Vitamin A &amp; D fortified milk, enriched bread, etc)</li> <li>iii. Use of artificial products (artificial sweeteners)</li> <li>iv. GMOs – increases nutrition and reduces undesirable aspects (high fat, etc) while not containing artificial items, but some have concerns with safety and allergens (ex – if a vegetable contains genes from a peanut, what are the effects on those that are allergic to peanuts?) Especially problematic because of lack of labeling regulation</li> </ul> </li> </ul> <p>6. Plant and Animal Industry</p> <ul style="list-style-type: none"> <li>a. Public Concerns - larger farms push out smaller farmers, growing world population, public perception of food production practices</li> <li>b. Current Solutions – <ul style="list-style-type: none"> <li>i. Public awareness campaigns</li> <li>ii. Farm buyouts – government pays small farmers to stop producing certain products that are produced more efficiently through larger farms</li> </ul> </li> </ul> <p>7. Animal Welfare</p> <ul style="list-style-type: none"> <li>a. Public Concerns – public perception of food production practices related to treatment of animals</li> <li>b. Current Solutions – <ul style="list-style-type: none"> <li>i. Public awareness campaigns</li> <li>ii. Government regulations on animal treatment and production practices</li> </ul> </li> </ul> <p>8. Ethics</p> <ul style="list-style-type: none"> <li>a. Public Concerns - some disagree with the slaughtering of animals for human consumption based on ethics</li> <li>b. Current Solutions – <ul style="list-style-type: none"> <li>i. Vegetarianism</li> <li>ii. GMOs – can insert animal protein genes into non-animal products, or potentially create animal tissues from cells without killing the animal</li> </ul> </li> </ul>
Objective 2:	Evaluate the potential benefits and drawbacks of possible solutions to current food safety issues.
Content Outline:	Content for this objective is derived from that of each of the above objectives.
<b>References</b>	
<p>Baker, M. C. &amp; Mikesell, R. E. (2005). <i>Animal Science: Biology &amp; Technology</i>. (2<sup>nd</sup> ed.) Pearson Education, Inc.: Upper Saddle River, NJ.</p> <p>Biotechnology Industry Organization. (2010). Healing, fueling, feeding: How biotechnology is enriching your life. Retrieved from: <a href="http://valueofbiotech.com/sites/default/files/pdfs/ValueofBiotechFINAL.pdf">http://valueofbiotech.com/sites/default/files/pdfs/ValueofBiotechFINAL.pdf</a></p> <p>Campbell, J. R., Kenealy, M. D., &amp; Campbell, K. L. (2003). <i>Animal Sciences: The Biology, Care, and Production of Domestic Animals</i>. (4<sup>th</sup> ed.) McGraw Hill: Boston, MA.</p> <p>Centers for Disease Control and Prevention (2011). CDC and Food Safety. Retrieved from: <a href="http://www.cdc.gov/foodsafety/cdc-and-food-safety.html">http://www.cdc.gov/foodsafety/cdc-and-food-safety.html</a></p>	

Cheng, M. (July, 2011). Food chain may contain seeds with deadly E. coli. *The Tennessean*. Retrieved from: <http://www.tennessean.com/article/20110701/NEWS/307010054/Food-chain-may-contain-seeds-deadly-E-coli>

Environment News Service (August, 2007). Food and mouth disease scares England. *Environment News*. Retrieved from: <http://www.ens-newswire.com/ens/aug2007/2007-08-08-04.html>

Filley, S. (2005). Weaning Beef Calves. Circular No. RegL&F0503. Oregon State University Extension Service: Roseburg, OR.

Gillespie, J. R. (2004). *Modern Livestock & Poultry Production* (7<sup>th</sup> ed.) Delmar Cengage Learning: Clifton Park, NY.

Gottlieb, S., & Wheeler, M. B. (2011). Genetically engineered animals and public health: Compelling benefits for health care, nutrition, the environment, and animal welfare. *Biotechnology Industry Organization*. Retrieved from: [http://www.bio.org/foodag/2011\\_ge%20animal\\_benefits\\_report.pdf](http://www.bio.org/foodag/2011_ge%20animal_benefits_report.pdf)

Human Genome Project Information. U.S. Department of Energy, Office of Science & Office of Biological and Environmental Research. [http://www.ornl.gov/sci/techresources/Human\\_Genome/elsi/gmfood.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml)

Jordans, F. (April 2009). WHO to stop using term 'swine flu' to protect pigs. *The Guardian*. Retrieved from: <http://www.guardian.co.uk/world/feedarticle/8483309>

Martin, A. (February, 2008). Largest recall of ground beef is ordered. *The New York Times*. Retrieved from: <http://www.nytimes.com/2008/02/18/business/18recall.html>

See Recent Recalls. FoodSafety.gov. U.S. Department of Health and Human Services. Retrieved from: <http://www.foodsafety.gov/recalls/recent/index.html>

Seperich, G. J. (2004). *Food Science and Safety* (2<sup>nd</sup> ed.). Pearson: Upper Saddle River, NJ.

United States Department of Agriculture. Biotechnology. Retrieved from: <http://usda.gov/wps/portal/usda/usdahome?contentid=BiotechnologyAgencyDesc.xml&navid=AGRICULTURE>

United States Food and Drug Administration. What we Do. Retrieved from: <http://www.fda.gov/AboutFDA/WhatWeDo/default.htm>

World Health Organization (2011). H5N1 avian influenza: Timeline of major events. Retrieved from: [http://www.who.int/csr/disease/avian\\_influenza/H5N1\\_avian\\_influenza\\_update.pdf](http://www.who.int/csr/disease/avian_influenza/H5N1_avian_influenza_update.pdf)