

Foodborne Illness

- Millions of people suffer the symptoms of foodborne illnesses.
- Most can be prevented by storing and cooking foods at their proper temperatures and preparing them under sanitary conditions.
- The FDA and other agencies focus on the potential hazards of food, the toxicity levels, and the potential risk posed to human beings.
- Safety standards are set. The USDA protects the food supply.

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Foodborne Illness

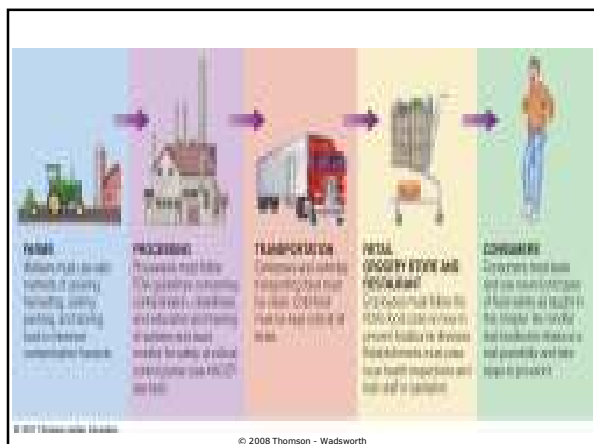
- Foodborne Infections and Food Intoxications
 - ✓ Foodborne Infections
 - Eating foods contaminated with infectious microbes
 - Two of the most common pathogens are *Campylobacter jejuni* and *Salmonella*.
 - ✓ Food Intoxications
 - Eating foods containing natural toxins or microbes that produce toxins
 - Most common is *Staphylococcus aureus*; most famous is *Clostridium botulinum*
 - ✓ Foodborne illnesses, diseases, organisms, onset and symptoms and prevention methods

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Foodborne Illness

- Food Safety in the Marketplace
 - ✓ Industry Controls
 - Pasteurization inactivates many of the microorganisms in food. Spoilage bacteria are still present.
 - Hazard Analysis Critical Control Points (HACCP) requires food manufacturers to identify points of contamination and implement controls.

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Foodborne Illness

- Food Safety in the Marketplace
 - ✓ Consumer Awareness
 - Wash hands with hot, soapy water before meals.
 - Expect clean tabletops, dinnerware, utensils, and food preparation sites.
 - Expect cooked foods to be served piping hot and salads to be fresh and cold.
 - Refrigerate carry-out foods within two hours.

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Foodborne Illness

- Food Safety in the Kitchen
 - ✓ Guidelines (see "How to Prevent Foodborne Illnesses")
 - Keep a clean, safe kitchen.
 - Avoid cross-contamination by separating raw eggs, meat, and seafood from other foods.
 - Keep hot foods hot.
 - Keep cold foods cold.

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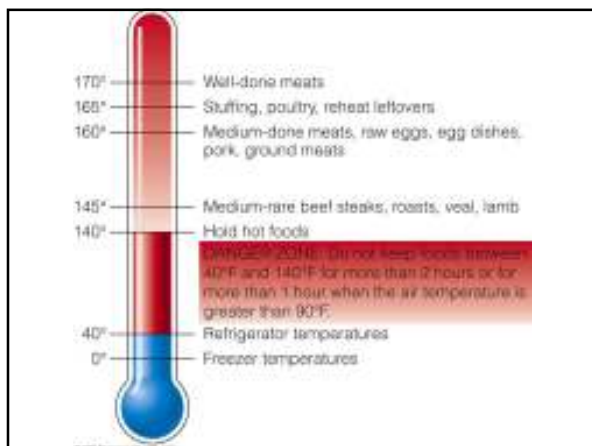
Foodborne Illness

- Food Safety in the Kitchen
 - ✓ Safe Handling of Meats and Poultry
 - Cook meat thoroughly and use a thermometer.
 - Read labeling instructions.
 - Recommended safe temperatures
 - Whole poultry: 180° F
 - Poultry breast and well-done meats: 170° F
 - Stuffing, ground poultry, and reheated leftovers: 165° F
 - Medium-done meats, raw eggs, egg dishes, pork, and ground meat: 160° F
 - Medium-rare meats, roasts, veal, and lamb: 145° F
 - Foods should not be kept between 40° F and 140° F for more than 2 hours
 - Refrigerator temperature: 40° F
 - Freezer temperature: 0° F

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Foodborne Illness

- Food Safety in the Kitchen
 - ✓ Mad Cow Disease
 - Can cause neurological damage to cows and humans
 - Ground beef and sausage are more of a concern.
 - Wild game questions
 - ✓ Avian influenza is normally found in chickens, ducks, and turkeys.
 - Possible human infection
 - May be contracted by having contact with birds, not by consuming them.

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Foodborne Illness

- Food Safety in the Kitchen
 - ✓ Safe Handling of Seafood
 - Undercooked or raw seafood can cause problems such as hepatitis, worms, parasites, viruses and other diseases.
 - Sushi may contain raw or cooled ingredients.
 - Raw oysters may be a concern.
 - Water pollution must be controlled.
 - Processing facilities must be clean, and temperatures should be controlled.

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Foodborne Illness

- Food Safety in the Kitchen
 - ✓ Other Precautions and Procedures
 - Abnormal odors with seafood – should smell fresh
 - Be mindful of safe refrigeration temperatures ($\leq 40^{\circ}$ F) and storage times.
 - ✓ Foods most commonly implicated in foodborne illnesses
 - Frequently unsafe
 - Raw milk and milk products
 - Raw or undercooked seafood, meat, poultry, and eggs
 - Raw sprouts and scallions

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Foodborne Illness

- Occasionally unsafe
 - ✓ Soft cheeses
 - ✓ Salad bar items
 - ✓ Unwashed berries and grapes
 - ✓ Sandwiches
 - ✓ Hamburgers
- Rarely unsafe
 - ✓ Peeled fruit
 - ✓ High-sugar foods
 - ✓ Steaming-hot foods

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Foodborne Illness

- Food Safety While Traveling
 - ✓ Traveler's diarrhea
 - Different microbes
 - Different standards for food and water

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Foodborne Illness

- Food Safety While Traveling
 - ✓ How to achieve food safety while traveling
 - Wash hands. Use antiseptic wipes or hand gels.
 - Eat only well cooked and hot foods.
 - Wash fruits and vegetables in purified water and peel.
 - Use bottled water.
 - Drink only treated, boiled, canned, or bottled beverages, consumed without ice.
 - Refuse dairy products unless properly pasteurized and refrigerated.
 - Do not purchase foods or drinks from street vendors.
 - Take antimotility and antibiotic agents prescribed by a physician, if necessary.

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Foodborne Illness

- Advances in Food Safety
 - ✓ Irradiation
 - Protection
 - Controlling molds in grains
 - Sterilizing spices and teas for storage at room temperature
 - Controlling insects and extending shelf life in fruits and vegetables
 - Destroying harmful bacteria in fresh and frozen beef, poultry, lamb and pork
 - Difference between irradiation and ultrahigh temperature (UHT) treatment



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Foodborne Illness

- Irradiation
 - ✓ Supported by FAO and WHO
 - ✓ Foods approved
 - Eggs
 - Raw beef, lamb, poultry, and pork
 - Spices and tea
 - Wheat
 - Potatoes, tomatoes, and onions
 - Strawberries, citrus fruits, and papaya

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Foodborne Illness

- Irradiation
 - ✓ Consumer Concerns about Irradiation
 - Negative emotions
 - Confusion with radioactive particles
 - ✓ Regulation of Irradiation
 - Labeling symbol
 - The FDA has regulations regarding specific uses and doses.
 - ✓ Other pasteurizing systems are high-intensity pulsed light or electric beams.

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Nutritional Adequacy of Foods and Diets

- The marketplace provides consumers with nutrition facts and guidelines.
- At home, consumers can minimize nutrient losses through proper food handling and cooking guidelines.

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Nutritional Adequacy of Foods and Diets

- Obtaining Nutrient Information
 - ✓ Nutritional labeling regulations
 - ✓ USDA's *Dietary Guidelines*
 - ✓ MyPyramid
- Minimizing Nutrient Losses
 - ✓ Keep fruits and vegetables refrigerated.
 - ✓ Keep cut fruits and vegetables and juices in airtight containers in the refrigerator.
 - ✓ Steam or microwave to prevent losses during cooking.

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Environmental Contaminants

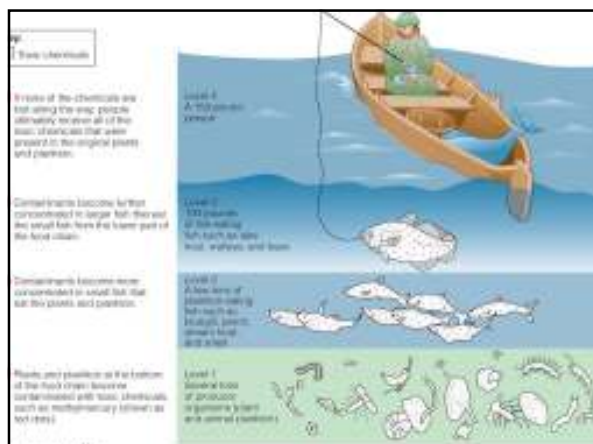
- Concerns of environmental contamination are many, but hazards are relatively small.
- It is important to be an informed consumer, keep alert to the possibility of contamination, and listen to public health announcements.
- Eating a variety of foods is an effective defensive strategy.

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Environmental Contaminants

- Harmfulness of Environmental Contaminants
 - ✓ Depends on its persistence
 - ✓ Each level of the food chain has a greater concentration than the one below, known as bioaccumulation.
 - ✓ Heavy metals and organic halogens can enter the food supply.

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Environmental Contaminants

• Harmfulness of Environmental Contaminants

✓ Methylmercury

- Can result in blindness, deafness, and lack of coordination, affects the intellect, and can cause death
- Fish can become contaminated with methylmercury.
- Infants born to pregnant women who consume methylmercury can be affected.

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Environmental Contaminants

• Harmfulness of Environmental Contaminants

✓ PBB and PCB

- Polybrominated biphenyl (PBB) was mixed with livestock feed in Michigan and caused nervous system problems and liver disorders in those who consumed the meat of the livestock.
- Polychlorinated biphenyls (PCB) were found in rice oil in Taiwan and resulted in fertility problems in men and women who had children with developmental issues.

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Environmental Contaminants

• Guidelines for Consumers

- ✓ Hazards appear to be small.
- ✓ FDA regulates
- ✓ Health agencies provide advisories (mercury).
- ✓ The EPA regulates commercial fishing.
- ✓ States test and monitor their own lakes and rivers.

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Natural Toxicants in Foods

- Many foods contain natural toxicants.
- It is the quantity consumed and the chemical structure of the contaminate, not the source, that makes it hazardous.
- Poisonous mushrooms
- Goitrogens in some vegetables
- Cyanogens that produce cyanide
- Solanine in potatoes

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Pesticides

- Pesticides can be safe when used appropriately, but leave residue on foods.
- When used inappropriately, they can be hazardous.
- Consumers can minimize exposure to pesticides in foods by following specific food preparation guidelines.
- Pesticides can improve crop yields.
- Alternative farming methods are being explored.

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Pesticides

- Hazards and Regulation of Pesticides
 - ✓ Hazards of Pesticides
 - Tolerance level set by government
 - People with weakened immune systems may be vulnerable.
 - ✓ Regulation of Pesticides
 - EPA and FDA keep within safe limits
 - Enforces the law
 - ✓ Pesticides from Other Countries
 - Policies must be established.
 - Imported foods contaminated with our banned pesticides that were sold outside the U.S. (circle of poison)

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Pesticides

- Monitoring Pesticides
 - ✓ Food in the Fields
 - Monitoring programs
 - Certifications with periodic inspections
 - ✓ Food on the Plate
 - Survey research to determine how much is consumed
 - The Total Diet Study estimates pesticide consumption.

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Pesticides

- Consumer Concerns
 - ✓ Minimizing Risks
 - Trim fat and remove skin.
 - Select fruits and vegetables without holes.
 - Wash fresh produce with a scrub brush and rinse.
 - Use a knife to peel.
 - Discard outer leaves.
 - Peel.
 - Eat a variety of foods.
 - Consider buying certified organic foods.

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Pesticides

- Consumer Concerns
 - ✓ Alternatives to Pesticides
 - Natural pesticides
 - Genetically altered plants; crop rotation
 - Using organisms to kill pests
 - Alternative farming methods

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Pesticides



- Consumer Concerns
 - ✓ Organically Grown Crops
 - Produce and market organic crops
 - USDA labeling for organic foods
 - 100% organic ingredients may claim 100% organic and use seal
 - 95% organic ingredients may claim organic and use seal
 - 70% organic ingredients may list up to three ingredients on the front of the package
 - Less than 70% organic ingredients may list them on the side panel but not make claims on the front of the package

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Foods made with 100 percent organic ingredients may claim "100% organic" and use the seal.

Foods made with at least 95 percent organic ingredients may claim "organic" and use the seal.

Foods made with at least 70 percent organic ingredients may list up to three of those ingredients on the front panel.

Foods made with less than 70 percent organic ingredients may list them on the side panel, but cannot make any claims on the front.

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Food Additives

- Many of the food additives used are preservatives.
- The FDA regulates the use of intentional additives.
- Consumers are concerned about the incidental additives.
- Regulations Governing Additives
 - ✓ The GRAS (generally recognized as safe) List
 - Additives that have been in use a long time
 - Believed to be safe based on current scientific evidence
 - Ongoing review

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Food Additives

- Regulations Governing Additives
 - ✓ The Delaney Clause
 - Additives that have not been shown to cause cancer in animals or humans
 - Criticism of being too strict and inflexible
 - No more than 1 in a million risk
 - ✓ Margin of Safety
 - Determined by experimental research
 - 100 times below the lowest level that is found to cause harm

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Food Additives

- Regulations Governing Additives
 - ✓ Risks versus Benefits
 - Use the lowest amount needed to get the effect
 - Cannot disguise faulty or inferior foods
 - Cannot deceive consumers
 - Cannot be used where nutrients are significantly destroyed
 - Cannot be used where their effects can be achieved by economical, sound manufacturing processes

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Food Additives

- Intentional Food Additives
 - ✓ Antimicrobial Agents
 - Salt and sugar
 - Nitrites and nitrates
 - Nitrites can be converted to nitrosamines in the human body.

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Food Additives

- Intentional Food Additives
 - ✓ Antioxidants
 - Vitamin C (erythorbic acid, sodium ascorbate)
 - Vitamin E (tocopherol)

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Food Additives

- Antioxidants
 - ✓ Sulfites (sulfur oxide, sodium sulfite, sodium bisulfate, potassium bisulfate, sodium metabisulfite, and potassium metabisulfate)
 - Prevent oxidation in many processed foods
 - Adverse reactions in people
 - Declare on the label
 - Inhibit use on raw foods
 - Destroy thiamin
 - ✓ BHA and BHT
 - Prevent rancidity in baked goods and snack foods
 - Cancer link – protect in small amounts, harm in larger amounts

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Food Additives

- Intentional Food Additives
 - ✓ Colors
 - Natural colors include annatto, caramel, carotenoids, dehydrated beets, and grape skins.
 - Artificial colors include blue #1 and #2, green #3, red #40 and #3, yellow #5 and #6.

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Food Additives

- Intentional Food Additives
 - ✓ Artificial Flavors and Flavor Enhancers
 - Natural flavors include spices, herbs, essential oils, fruits, and fruit juices.
 - Artificial flavors include artificial sweeteners.
 - Flavor enhancers include MSG or monosodium glutamate.
 - Used in Asian foods, canned vegetables, soups, and processed meats
 - MSG symptom complex has adverse reactions in some people.
 - Must be listed on the label

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Food Additives

- Intentional Food Additives
 - ✓ Texture and Stability
 - Common emulsifiers – for stabilization
 - Lecithin
 - Alginates
 - Mono- and diglycerides
 - Common gums – to thicken and gel
 - Agar, alginates, and carrageenan
 - Guar, locust bean, and psyllium
 - Pectin
 - Xanthan gum
 - Gum Arabic
 - Cellulose derivatives

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Food Additives

- Intentional Food Additives
 - ✓ Nutrient Additives
 - Appropriate uses
 - Correct dietary deficiencies
 - Restore nutrients to levels prior to storage, handling, and processing
 - Balance vitamin, mineral, and protein content of a food in proportion to its energy content
 - Correct nutritional inferiority

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Food Additives

- Nutrient Additives
 - ✓ Common Nutrient Additives
 - Thiamin, niacin, riboflavin, folate, and iron in grain products
 - Iodine in salt
 - Vitamins A and D in milk
 - Vitamin C and calcium in fruit drinks
 - Vitamin B₁₂ in vegetarian foods

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Food Additives

- Indirect or incidental food additives enter food through harvesting, production, processing, storage, or packaging.
 - ✓ Acrylamide
 - Causes cancer and nerve damage in high doses
 - Found in potatoes cooked at high temperatures (french fries and potato chips, breakfast cereals, and cookies)
 - Also classified as a genotoxicant – a substance that mutates or damages genetic materials

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Food Additives

- Indirect Food Additives
 - ✓ Microwave Packaging
 - Active packaging is where the packaging components migrate into food.
 - Passive packaging is where the package simply holds the foods but components can migrate into food at high temperatures.
 - Test empty glass or ceramic containers in microwave for 1 minute:
 - If warm, do not use.
 - If lukewarm, it is safe for short-term heating.
 - If cool, it is safe for long-term cooking.

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Food Additives

- Indirect Food Additives
 - ✓ Dioxins
 - Chemical pollutants created as by-products of chemical manufacturing, incineration, chlorine bleaching of paper pulp, and other industrial processes
 - Found in coffee filters, milk cartons, paper plates, and frozen food packages in minute quantities
 - ✓ Decaffeinated Coffee
 - Methylene chloride found in decaffeinated coffee
 - Depends on the decaffeinating process used

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Food Additives

- Indirect Food Additives
 - ✓ Hormones
 - Bovine growth hormone (BGH) in cattle to produce leaner meats and dairy cows to produce more milk
 - All cows make this hormone naturally.
 - Food levels are regulated and monitored.
 - Digested by the human body
 - Still controversy

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Food Additives

- Indirect Food Additives
 - ✓ Antibiotics
 - Given to animals and residues remain in meat and milk
 - People with sensitivities may suffer allergic reactions.
 - Antibiotic resistance is a problem.

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Consumer Concerns about Water

- Water may contain infectious microorganisms, environmental contaminants, pesticide residues, and additives.
- The EPA monitors the safety of public water systems.
- Many consumers are choosing home water treatment systems or drinking bottled water.

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Consumer Concerns about Water

- Sources of Drinking Water (potable water)
 - ✓ Surface water
 - Sources include lakes, rivers, and reservoirs.
 - Readily contaminated through acid rain, runoff from highways and urban areas, pesticide runoff from agricultural areas, and industrial wastes
 - Refreshed by fresh rain, aeration, sunlight, plants, and microorganisms

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Consumer Concerns about Water

- Sources of Drinking Water
 - ✓ Ground water
 - Sources include underground aquifers.
 - Supplies rural areas and pumped by wells
 - Contaminated more slowly but more permanently
 - Especially susceptible to contamination from hazardous waste sites, dumps, landfills, underground tanks storing gasoline and other chemicals, and improperly discarded household chemicals and solvents

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Consumer Concerns about Water

- Water Systems and Regulations
 - ✓ Home Water Treatments
 - Shop carefully.
 - Advantages and disadvantages
 - Determine the quality of home water first.

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Consumer Concerns about Water

- Water Systems and Regulations
 - ✓ Bottled Water
 - FDA has quality and safety standards.
 - Expensive
 - Water source must be identified
 - Refrigerate after opening
 - May contain contaminants

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Food Biotechnology

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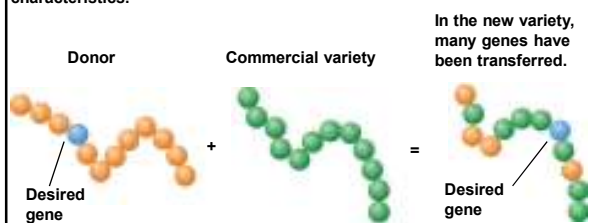
Food Biotechnology

- Biotechnology companies tell us: with proper safeguards and controls, provides opportunities to overcome food shortages, improve the environment, and eliminate disease.
- However, strong evidence is showing to the contrary. GMOs are the **LARGEST** unmonitored experiment in the history of life.

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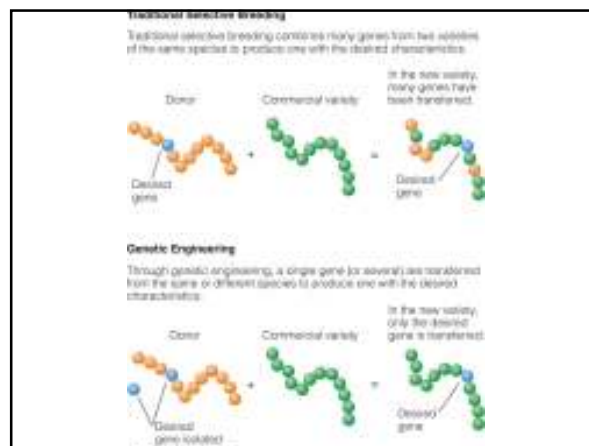
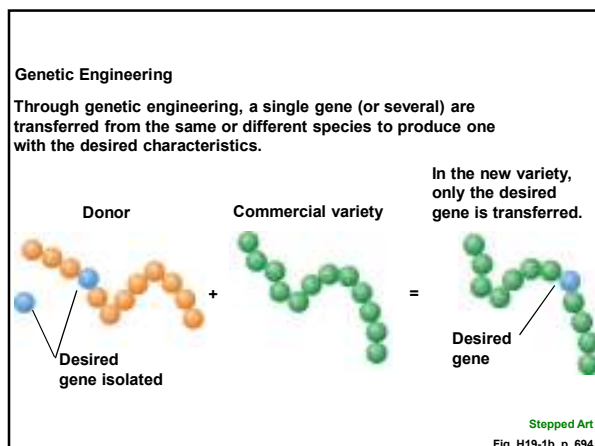
Traditional Selective Breeding

Traditional selective breeding combines many genes from two varieties of the same species to produce one with the desired characteristics.



Stepped Art

Fig. H19-1a, p. 694



The Promises of Genetic Engineering

- Also called genetically modified (GM) or genetically engineered (GE) foods
- Extended Shelf Life – tomato example
- Improved Nutrient Composition – biofortification
- Efficient Food Processing – bacteria mass produce rennin for cheese making
- Efficient Drug Delivery – biopharmacy by using plants and animals to produce drugs
- Genetically Assisted Agriculture – plant pesticides grown by the plant itself
- Other Possibilities

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The Potential Problems and Concerns

- Disruption of natural ecosystems
- Introduction of diseases
- Increased cancer risk
- Introduction of allergens and toxins
- Creation of biological weapons
- Ethical dilemmas
- Lack of rigorous testing and labeling

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FDA Regulations

- Many foods are already genetically altered through selective breeding.
- Many foods are not substantially different.
- Foods that are substantially different require labeling to identify that difference.
- Allergy-causing substances must be labeled.
- Can these regulations ensure an improved food supply?

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