Consumer Concerns About Foods And Water
Foodborne Illness

- FDA lists foodborne illness as the leading food safety concern
- Outbreaks of food poisoning outnumber other food contamination
- Leading cause of food contamination
- CDC estimates 48 million people experience food borne illness annually,
  - 3000 deaths
- Most vulnerable are pregnant women, children, elderly, those with weakened immune system
Foodborne Infections

- Caused by eating foods contaminated by infectious microbes
- Most common – Norovirus and Salmonella
- Enter the GI tract in contaminated foods such as undercooked poultry, eggs, meats, unpasteurized milk
- Symptoms include: nausea, vomiting, diarrhea, fever
Food Intoxications

- Caused by eating foods that containing microbes that produce toxins
- *Staphylococcus aureus*
  - found in meats, poultry, picnic salads, cream filled pastry
- *Botulism*
  - Botulism toxin found in improperly canned foods (meats, vegetables, oils)
  - difficulty seeing, speaking, swallowing, breathing
  - death can occur within 24 hours
# Foodborne Illnesses

## Table 19-1 Foodborne Illnesses

<table>
<thead>
<tr>
<th>Common Organism Name</th>
<th>Most Frequent Food Sources</th>
<th>Onset and General Symptoms</th>
<th>Prevention Methods*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foodborne Infections</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campylobacter (KAM-pee-oh-BAK-ter) bacterium</td>
<td>Raw and undercooked poultry, unpasteurized milk, contaminated water</td>
<td>Onset: 2 to 5 days. Diarrhea, vomiting, abdominal cramps, fever; sometimes bloody stools; lasts 2 to 10 days.</td>
<td>Cook foods thoroughly; use pasteurized milk; use sanitary food-handling methods.</td>
</tr>
<tr>
<td>E. coli: O157* bacterium</td>
<td>Undercooked ground beef, unpasteurized milk and juices, raw fruits and vegetables, contaminated water, and person-to-person contact</td>
<td>Onset: 1 to 8 days. Severe bloody diarrhea, abdominal cramps, vomiting; lasts 5 to 16 days.</td>
<td>Cook ground beef thoroughly; use pasteurized milk; use sanitary food-handling methods; use treated, boiled, or bottled water.</td>
</tr>
<tr>
<td>Norovirus</td>
<td>Person-to-person contact; raw foods, salads, sandwiches</td>
<td>Onset: 1 to 2 days. Vomiting; lasts 1 to 2 days.</td>
<td>Use sanitary food-handling methods.</td>
</tr>
<tr>
<td>Listeria (lis-TER-ee-AH) bacterium</td>
<td>Unpasteurized milk; fresh soft cheeses; luncheon meats, hot dogs</td>
<td>Onset: 1 to 21 days. Fever, muscle aches; nausea, vomiting, blood poisoning, complications in pregnancy, and meningitis (stiff neck, severe headache, and fever).</td>
<td>Use sanitary food-handling methods; cook foods thoroughly; use pasteurized milk.</td>
</tr>
<tr>
<td>Clostridium (klo-STRID-ee-um) perfringens (per-FRINGE-enz) bacterium</td>
<td>Meats and meat products stored at between 120°F and 130°F</td>
<td>Onset: 8 to 16 hours. Abdominal pain, diarrhea, nausea; lasts 1 to 2 days.</td>
<td>Use sanitary food-handling methods; use pasteurized milk; cook foods thoroughly; refrigerate foods promptly and properly.</td>
</tr>
<tr>
<td>Salmonella (sal-moh-NEL-ah) bacteria (&gt;2300 types)</td>
<td>Raw or undercooked eggs, meats, poultry, raw milk and other dairy products, shrimp, frog legs, yeast, coconut, pasta, and chocolate</td>
<td>Onset: 1 to 3 days. Fever, vomiting, abdominal cramps, diarrhea; lasts 4 to 7 days; can be fatal.</td>
<td>Use sanitary food-handling methods; pasteurize milk; cook foods thoroughly; refrigerate foods promptly and properly.</td>
</tr>
<tr>
<td><strong>Food Intoxications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botulism (BOT-chew-izm)</td>
<td>Anaerobic environment of low acidity (canned corn, peppers, green beans, soups, beets, asparagus, mushrooms, ripe olives, spinach, tuna, chicken, chicken liver, liver pâté, luncheon meats, ham, sausage, stuffed eggplant, lobster, and smoked and salted fish)</td>
<td>Onset: 4 to 36 hours. Nervous system symptoms, including double vision, inability to swallow, speech difficulty, and progressive paralysis of the respiratory system; often fatal; leaves prolonged symptoms in survivors.</td>
<td>Use proper canning methods for low-acid foods; refrigerate homemade garlic and herb oils; avoid commercially prepared foods with leaky seals or with bent, bulging, or broken cans. Do not give infants honey because it may contain spores of Clostridium botulinum, which is a common source of infection for infants.</td>
</tr>
<tr>
<td>Staphylococcal (STAF-il-oh-KOK-al) food poisoning (produced by Staphylococcus aureus bacterium)</td>
<td>Toxin produced in improperly refrigerated meats; egg, tuna, potato, and macaroni salads; cream-filled pastries</td>
<td>Onset: 1 to 6 hours. Diarrhea, nausea, vomiting, abdominal cramps, fever; lasts 1 to 2 days.</td>
<td>Use sanitary food-handling methods; cook food thoroughly; refrigerate foods promptly and properly; use proper home-canning methods.</td>
</tr>
<tr>
<td>Toxoplasma (TOX-so-PLAZ-ma) parasite</td>
<td>Raw or undercooked meat; unwashed fruits and vegetables; contaminated water</td>
<td>Onset: 7 to 21 days. Swollen glands, fever, headache, muscle pain, stiff neck.</td>
<td>Use sanitary food-handling methods; cook foods thoroughly.</td>
</tr>
</tbody>
</table>

*NOTE: Travelers’ diarrhea is most commonly caused by E. coli, Campylobacter jejuni, Shigella, and Salmonella.

*The “How To” on pp. 628–629 provides more details on the proper handling, cooking, and refrigeration of foods.

*The most serious strain is E. coli STEC O157.
Foodborne Illnesses

- Food safety in the marketplace
  - Transmission of foodborne illness has changed
    - Errors in the commercial setting
- Industry controls
  - Hazard Analysis Critical Control Points (HACCP) system
  - Imported foods
Foodborne Illness

Food Safety in the Marketplace

- Transmission of foodborne illness has changed
- Errors in the commercial setting

Industry Controls

- Hazard Analysis Critical Control Points (HACCP) requires food manufacturers to identify points of contamination and implement controls.
- Pasteurization - heat processing which inactivates many of the microorganisms in food. Spoilage bacteria are still present.

Imported foods
- Must display Country of Origin Label
Food Safety from Farm to Table

FARM

Workers must use safe methods of growing, harvesting, sorting, packing, and storing food to minimize contamination hazards.

PROCESSING

Processors must follow FDA guidelines concerning contamination, cleanliness, and education and training of workers and must monitor for safety at critical control points.

TRANSPORTATION

Containers and vehicles transporting food must be clean. Cold food must be kept cold at all times.

RETAIL

Employees must follow the FDA's food code on how to prevent foodborne illnesses. Establishments must pass local health inspections and train staff in sanitation.

TABLE

Consumers must learn and use sound principles of food safety as taught in this chapter. Be mindful that foodborne illness is a real possibility and take steps to prevent it.
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.
    - Use left-overs within 3-4 days
Foodborne Illnesses

- Food safety in the kitchen
  - Keep a clean, safe kitchen
  - Avoid cross-contamination
  - Keep hot foods hot
  - Keep cold foods cold
Food Safety In The Kitchen

- Keep a clean, safe kitchen
- Avoid cross-contamination
  - Keep raw meat, poultry, fish separate from all other foods
  - Wash all surfaces that have come in contact with them with warm, soapy, water
  - Wash your hands with warm water and soap for at least 20 seconds before preparing or eating food
How to Prevent Food Poisoning: Keep a Clean Kitchen

To keep a clean kitchen:

- Use warm soapy water to wash hands, utensils, dishes, cutting boards, and countertops.
- Avoid cross contamination by washing all surfaces that have been in contact with raw meats, poultry, or eggs before using.
- Mix food with utensils, not hands; keep hands and utensils away from mouth, nose, hair.
- Avoid coughing or sneezing over food. A person with a skin infection or infectious disease should not prepare food.

- Wash or replace sponges and towels regularly.
- Clean up food spills and crumb-filled crevices.

In general:

- Throw out foods with off odors.
- Do not even taste food that is suspect.
- Do not buy or use items that appear to have been opened; check safety seals, buttons, and rings. Observe expiration dates.
- Follow label instructions for storing and preparing packaged and frozen foods.
How To Prevent Food Poisoning: Keep Foods Hot

Use a meat thermometer to test the internal temperature of meats and poultry. Insert the thermometer between the thigh and the body of the turkey or in the thickest part of other meats, making sure the tip of the thermometer is not in contact with the bone. Cook to the temperature indicated for that particular meat; cook hamburgers to at least medium well done. Cook stuffing separately or stuff poultry just prior to cooking.

When serving foods for longer than 2 hours, maintain temperatures above 140°F. Heat leftovers thoroughly to at least 140°F.

Cook eggs and seafood throughly before eating them.
Food Safety In The Kitchen

- Keep hot foods hot
- Cook hamburgers to 160 degrees
How Prevent Food Poisoning: Keep Foods Cold

To keep cold foods cold

Keep cold foods at least 40°F or less. Refrigerate leftovers promptly; use shallow containers to help foods cool faster.

Keep frozen foods at least 0°F or less.

Tote lunches in a thermal bag or box. Freeze plastic bottles or pouches of beverages and let them keep the lunch cool as they thaw out through the morning.
Meat and Poultry Safety, Grading, and Inspection Seals

Neither inspection nor grading guarantees that the product will not cause foodborne illnesses, but consumers can help to prevent foodborne illnesses by following the safe handling instructions.

The mandatory "Inspected and Passed by the USDA" seal ensures that meat and poultry products are safe, wholesome, and correctly labeled. Inspection does not guarantee that the meat is free of potentially harmful bacteria.

The voluntary "Graded by USDA" seal indicates that the product has been graded for tenderness, juiciness, and flavor. Beef is graded Prime (abundant marbling of the meat muscle), Choice (less marbling), or Select (lean). Similarly, poultry is graded A, B, or C.

Safe Handling Instructions

This product was prepared from inspected and passed meat and/or poultry. Some food products may contain bacteria that could cause illness if the product is mishandled or cooked improperly. For your protection, follow these safe handling instructions.

- Keep refrigerated or frozen. Thaw in refrigerator or microwave.
- Keep raw meat and poultry separate from other foods. Wash working surfaces (including cutting boards), utensils, and hands after touching raw meat or poultry.
- Cook thoroughly.
- Keep hot foods hot. Refrigerate leftovers immediately or discard.

The USDA requires that safe handling instructions appear on all packages of meat and poultry.
Safe Handling Instructions

This product was prepared from inspected and passes meat and/or poultry. Some food products may contain bacteria that can cause illness if the product is mishandled or cooked improperly. For your protection, follow these safe handling instructions.

- Keep refrigerated or frozen.
- Thaw in refrigerator or microwave.
- Keep raw meat and poultry separate from other foods.
- Wash working surfaces (including cutting boards), utensils, and hands after touching raw meat or poultry.
- Cook thoroughly.
- Keep hot foods hot.
- Refrigerate leftover immediately or discard.
Recommended Safe Temperatures (Fahrenheit)

170° Well-done meats
165° Stuffing, poultry; reheat leftovers
160° Medium-done meats, raw eggs, egg dishes, pork, ground meats
145° Medium-rare beef steaks, roasts, veal, lamb
140° Hold hot foods

DANGER ZONE: Do not keep foods between 40°F and 140°F for more than 2 hours or for more than 1 hour when the air temperature is greater than 90°F.

40° Refrigerator temperatures
0° Freezer temperatures
Foodborne Illness

- Safe handling of meats and poultry
  - Mad Cow Disease (bovine spongiform encephalopathy)
    - Affects central nervous system of cattle causing neurological damage to cows, deer and elk
    - Can affect humans who consume infected meat
    - Ground beef and sausage are more of a concern.
  - 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.
  - “Swine Flu” (H1N1) is not caused by eating pork
Foodborne Illness

- Food Safety in the Kitchen
  - Safe Handling of Seafood
    - Undercooked or raw seafood can cause hepatitis, worms, parasites, viruses and other diseases.
    - Raw oysters may carry hepatitis A.
    - Water pollution must be controlled.
    - Processing facilities must be clean, and temperatures should be controlled.
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.
    - “When in doubt, throw it out!”
  - 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
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
### TABLE 19-2  Safe Refrigerator Storage Times (≤40°F)

<table>
<thead>
<tr>
<th>Time</th>
<th>Food Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 to 2 Days</strong></td>
<td>Raw ground meats, breakfast or other raw sausages, raw fish or poultry; gravies</td>
</tr>
<tr>
<td><strong>3 to 5 Days</strong></td>
<td>Raw steaks, roasts, or chops; cooked meats, poultry, vegetables, and mixed dishes; lunchmeats (packages opened); mayonnaise salads (chicken, egg, pasta, tuna); fresh vegetables (spinach, green beans, tomatoes)</td>
</tr>
<tr>
<td><strong>1 Week</strong></td>
<td>Hard-cooked eggs, bacon or hot dogs (opened packages); smoked sausages or seafood; milk, cottage cheese</td>
</tr>
<tr>
<td><strong>1 to 2 Weeks</strong></td>
<td>Yogurt; carrots, celery, lettuce</td>
</tr>
<tr>
<td><strong>2 to 4 Weeks</strong></td>
<td>Fresh eggs (in shells); lunchmeats, bacon, or hot dogs (packages unopened); dry sausages (pepperoni, hard salami); most aged and processed cheeses (Swiss, brick)</td>
</tr>
<tr>
<td><strong>2 Months</strong></td>
<td>Mayonnaise (opened jar); most dry cheeses (Parmesan, Romano)</td>
</tr>
</tbody>
</table>
Prevent Food-Borne Illness While Traveling

- **Traveler’s Diarrhea**
  - Other countries may have lower cleanliness standards for food and water
  - Other countries have different microbes
  - 50-50 chance of catching “travelers’ diarrhea” caused by E. Coli, Shigella, Salmonella
    - Symptoms include nausea, vomiting and diarrhea
  - “Boil it, cook it, peel it or forget it”
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 antidiarrheal medication, if necessary.
Foodborne Illness

- Advances in Food Safety
  - Irradiation (cold pasturization)
  - 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
  - Ultrahigh temperature (UHT) treatment
    - brief exposure to high temperatures
Nutritional Adequacy Of Foods And Diets

- Minimizing nutrient loss
  - Refrigerate prior to use
  - Store cut fruits and veggies in airtight containers and refrigerate
  - Wash before cutting
  - Steam or microwave
Environmental Contaminants

- Harmfulness of Environmental Contaminants
  - Depends on its persistence
  - Bioaccumulation.
    - Each level of the food chain has a greater concentration than the one below
    - Heavy metals and organic halogens can enter the food supply.
1. Plants and plankton at the bottom of the food chain become contaminated with toxic chemicals, such as methylmercury (shown as red dots).

2. Contaminants become more concentrated in small fish that eat the plants and plankton.

3. Contaminants become further concentrated in larger fish that eat the small fish from the lower part of the food chain.

4. If none of the chemicals are lost along the way, people ultimately receive all of the toxic chemicals that were present in the original plants and plankton.

Key:
- Toxic chemicals

Level 1
- Several tons of producer organisms (plant and animal plankton)

Level 2
- A few tons of plankton-eating fish such as bluegill, perch, stream trout, and smelt

Level 3
- 100 pounds of fish-eating fish such as lake trout, walleye, and bass

Level 4
- A 150-pound person
Environmental Contaminants

- Harmfulness of Environmental Contaminants
  - Methylmercury toxicity
    - 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.
Harmfulness of Environmental Contaminants

- **Methylmercury**
  - Avoid shark, swordfish, king mackerel and tilefish
  - Limit other fish to 12 ounces/week
  - 6 oz white albacore tuna
- **Fish high in omega-3 fatty acids and low in mercury**
  - Salmon, herring, sardines, lake trout, shad, mackerel, whitefish, flounder/sole, pollock
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.
Natural Toxicants

- Poisonous Mushrooms
- Goitrogens - can enlarge the thyroid gland.
  - Found in cabbage, brussel sprouts, cauliflower, broccoli, radishes.
- Cyanogens - can produce cyanide upon activation by a specific plant enzyme.
  - Found in lima beans, fruit seeds
- Solanine - narcotic; toxic in large quantities
  - Found in the green layer under the skin of potatoes
  - Due to improper storage in light, very cold, or very warm environment
  - May cause gastrointestinal disturbances
Pesticides

Hazards:
- Children, elderly and those with compromised immune function are at risk.

Regulation:
- **EPA** establishes tolerance level
  - Max amount of residue permitted when food used according to label.
  - Set well below level of harm
- **FDA** monitors foods and livestock.

Pesticides from Other Countries:
- Standards and inconsistent with U.S. standards.
# Minimize Pest Residues

## TABLE 19-3 Minimize Pesticide Residues

### When Shopping for Foods
- Select fruits and vegetables that do not have holes.
- Select a variety of foods to minimize exposure to any one pesticide.
- Consider buying certified organic foods when shopping for produce most likely to be contaminated (see Table 19-4, p. 641).

### When Preparing Foods
- Trim the fat from meat, and remove the skin from poultry and fish; discard fats and oils in broths and pan drippings (pesticide residues concentrate in the animal’s fat).
- Wash fresh produce in warm running water, use a scrub brush, and rinse thoroughly.
- Use a knife to peel an orange and grapefruit; do not bite into the peel.
- Discard the outer leaves of leafy vegetables such as cabbage and lettuce.
- Peel waxed fruits and vegetables; waxes don’t wash off and can seal in pesticide residues.
- Peel vegetables such as carrots and fruits such as apples when possible (peeling removes dirt, bacteria, and pesticides that remain in or on the peel, but also removes fibers, vitamins, and minerals).
### Most and Least Pesticide-Contaminated Fruits and Vegetables

<table>
<thead>
<tr>
<th>Most Contaminated</th>
<th>Least Contaminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>Onions</td>
</tr>
<tr>
<td>Celery</td>
<td>Corn</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Pineapples</td>
</tr>
<tr>
<td>Peaches</td>
<td>Avocados</td>
</tr>
<tr>
<td>Spinach</td>
<td>Asparagus</td>
</tr>
<tr>
<td>Nectarines (imported)</td>
<td>Peas</td>
</tr>
<tr>
<td>Grapes (imported)</td>
<td>Mangoes</td>
</tr>
<tr>
<td>Bell peppers</td>
<td>Eggplant</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Cantaloupe</td>
</tr>
<tr>
<td>Blueberries</td>
<td>Kiwi</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Cabbage</td>
</tr>
<tr>
<td>Kale</td>
<td>Watermelon</td>
</tr>
</tbody>
</table>

**NOTE:** These fruits and vegetables are ranked in order of their pesticide load.
Consumer Concerns

- Organically grown crops
- USDA regulations define the use of organic products
Food Labels For Organic Products

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.
Food Additives

- Food additives used are preservatives, flavors, prevent spoilage, prevent bacteria production.
- The FDA regulates the use of intentional additives.
  - Effective
  - Detectable and measurable in final food product
  - Safe
Food Additives

- Regulations Governing Additives
  - The GRAS (generally recognized as safe) List
    - Additives that have been in use a long time such as salt, sugar, spices
    - Believed to be safe based on current scientific evidence
    - Ongoing review
  - Delaney Clause specifies that:
    - No substance that is known to cause cancer in animals or human at any dose level shall be added to food.
    - Deemed safe if lifetime use presents no more than one in a million risk of cancer to humans
Food Additives

Margin of Safety.
- Additives are permitted in foods at 100 times lower than the lowest level known to be harmful

Risk vs Benefit:
- Benefit must outweigh the risk.
- Additives cannot be used:
  - To disguise faulty products.
  - To deceive the consumer.
  - Where they destroy nutrients.
  - Where effect can be achieved via sound manufacturing process.
Intentional Food Additives

- **Antimicrobials:**
  - Salt, sugar
  - Nitrites - preserve color, enhance flavor, protect against bacterial growth including botulism
  - Bacteriophages

- **Antioxidants:**
  - Vitamins C & E
  - Sulfites (Salt with sulfur)
    - Destroys Thiamin
  - BHA, BHT - prevent rancidity in baked foods and snacks
Intentional Food Additives

- Artificial Colors:
  - Blue, Red, Green & Yellow
- Carotenoids - natural coloring
- Artificial Flavors
  - MSG - monosodium glutamate
- Texture and Stability:
  - Dextrin, Pectins
    - Gums-Carrageen, guar, agar
    - Yeast- thickening
- Nutrients:
  - A, D, Thiamin, Riboflavin, Niacin, Iron, Folate, Iodide
# Intentional Food Additives

## Table 19-5: Intentional Food Additives

<table>
<thead>
<tr>
<th>Food Additive</th>
<th>Purpose</th>
<th>Common Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobials</td>
<td>Prevent food spoilage from microorganisms</td>
<td>Salt, sugar, nitrites and nitrates (such as sodium nitrate), bacteriophages</td>
</tr>
<tr>
<td>Antioxidants</td>
<td>Prevent oxidative changes in color, flavor, or texture and delay rancidity and other damage to foods caused by oxygen</td>
<td>Vitamin C (erythorbic acid, sodium ascorbate), vitamin E (tocopherol), sulfites, BHA and BHT</td>
</tr>
<tr>
<td>Colors</td>
<td>Enhance appearance</td>
<td>Artificial: indigotine, erythrosine, tartrazine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Natural: annatto (yellow), caramel (yellowish brown), carotenoids (yellowish orange), dehydrated beets (reddish brown), grape skins (red, green)</td>
</tr>
<tr>
<td>Flavors</td>
<td>Enhance taste</td>
<td>Salt, sugar, spices, artificial sweeteners, MSG</td>
</tr>
<tr>
<td>Emulsifiers and gums</td>
<td>Thicken, stabilize, or otherwise improve consistency and texture</td>
<td>Emulsifiers: lecithin, alginates, mono- and diglycerides</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gums: agar, alginates, carrageenan, guar, locust bean, psyllium, pectin, xanthan gum, gum arabic, cellulose derivatives</td>
</tr>
<tr>
<td>Nutrients (vitamins and minerals)</td>
<td>Improve the nutritive value by replacing vitamins and minerals lost in processing (enrichment) or adding vitamins or minerals that may be lacking in the diet (fortification)</td>
<td>Thiamin, niacin, riboflavin, folate, 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)</td>
</tr>
</tbody>
</table>
Indirect Food Additives

Acrylamide-
- Formed when high carbohydrate foods are cooked at high temperatures (french fries)
- High doses causes cancer in animals

Microwave Packaging
- Don’t reuse
- Use glass or ceramic containers marked microwave safe

Dioxins
- Compounds formed during chlorine treatment of wood pulp in paper making (paper plates, coffee filters)

Decaffeinated coffee
- Methylene chloride is used

Hormones
- Bovine Growth Hormone (BGH)

Antibiotics-given to livestock; residues may remain in meat and milk
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.
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
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
Consumer Concerns about Water

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

- Water Systems and Regulations
  - Bottled Water
  - FDA has quality and safety standards comparable to those set for public drinking water.
  - Expensive
  - Water source must be identified
  - Refrigerate after opening
  - May contain contaminants; Not necessarily more pure than tap water
Consumer Concerns

End of Chapter 19