

# **DISEASES TRANSMITTED BY FOODS**

( A CLASSIFICATION AND SUMMARY )

SECOND EDITION

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
PUBLIC HEALTH SERVICE  
CENTERS FOR DISEASE CONTROL  
CENTER FOR PROFESSIONAL DEVELOPMENT AND TRAINING  
ATLANTA, GEORGIA 30333**

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## INTRODUCTION

This reference summarizes the following data: etiologic agents and their nature, sources and important reservoirs, epidemiology, foods frequently involved in outbreaks, specimens and samples to take in outbreak investigations, laboratory approaches, and general control measures of foodborne diseases that have been reported throughout the world. This information is organized for rapid review and comparison of the same kinds of data about different diseases.

Diseases transmitted by foods are frequently classified either as poisonings or infections. Poisonings are caused by ingesting toxicants that are found in tissues of certain plants and animals, metabolic products (toxins) formed and excreted by microorganisms (such as bacteria, fungi, or algae) while they multiply in foods, or poisonous substances that may be intentionally or incidentally added to foods as a result of producing, processing, transporting, or storing. Infections are caused by the entrance of pathogenic microorganisms into the body and the reaction of body tissues to their presence or to the toxins they generate within the body. Intestinal infections may be manifested by *in vivo* enterotoxin production or mucosal penetration. After mucosal penetration, the organisms multiply in the mucosa or pass into other tissues. This classification is illustrated on the adjacent page.

In this reference, the foodborne diseases are classified on the basis of the type of agent responsible for the illness--bacterial, viral and rickettsial, parasitic (protozoan, cestodes, nematodes, trematodes, helminths), fungal (mycotoxin or mushroom), poisonous plants, toxic animals, poisonous chemicals, and radionuclides. In each category, the diseases of contemporary importance are listed first. The relative importance of each disease does, however, vary from time to time and from place to place. This reference also includes diseases that have been reported as being foodborne even though proof is lacking. It also includes diseases in which the causative agent has been found in foods but transmission through foods is unknown, and enteric diseases in which the transmission through foods is possible. No attempt has been made to discuss all poisonous plants, poisonous chemicals, or radionuclides. Only those plants that are used as food or mistaken for food and those that illustrate a different class of poison are reviewed. There has been no attempt to list all foods that have been incriminated as vehicles in outbreaks. Except in the cases of rare diseases, only foods of primary public health importance are listed.

The symptoms of each disease are usually in the order either of their occurrence or of their predominance. Individual cases, however, will not manifest all the symptoms and, in some cases, additional signs and symptoms will occur. The incubation period (latent period in the case of poisonings) of a disease is the time from ingestion of the contaminated food until the first symptoms appear; individual cases may have incubation periods that vary from the stated times. Control measures are listed in order of their relative importance. A complete bibliography of the literature from which this summary was compiled would be extensive, so only one or a few specific references for each disease are given, along with review articles and texts in each category.

Blank spaces in the text indicate that the appropriate information is insignificant, is unknown, or has not come to the attention of the author. The author encourages comment on missing diseases and information and submission of additional data for revision of the summary.

DISEASES TRANSMITTED BY FOODS (1-14)<sup>1</sup>

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
<b>SALMONELLOSES</b>							
Diseases of Contemporary Importance							
Salmonellosis (8, 11, 16, 111, 123, 134, 183, 239, 275) <sup>1</sup>	<i>Salmonella choleraesuis</i> , <i>S. enteritidis</i> serotypes Typhimurium, Heidelberg, Derby, Java, Infantis, Agona, Enteritidis, Montevideo, Newport, Panama, Stanley, etc. Over 1600 serotypes known, but only about 50 commonly occur.	Gram-negative, non-sporeforming, (mostly motile) rod. Aerobic, facultatively anaerobic. Possesses 0 (somatic) and two phases of H (flagellar) antigens. Usually more than 10 <sup>8</sup> required to cause illness.	5 to 72 hours, usually 12 to 36 hours. Diarrhea, abdominal pain, chills, fever, vomiting, dehydration, prostration, anorexia, headache, malaise. Duration of several days. Septicemia or focal infection may also occur.	Feces of infected domestic or wild animals and man. Infants, aged and malnourished persons and those with concomitant diseases are more susceptible. Carrier state usually lasts a few days to a few weeks, but sometimes for months. Fifty percent of infected persons carry salmonellae for 2-4 weeks. Occasionally waterborne.	Meat, poultry and eggs and their products. Other incriminated foods have included coconut, yeast, cottonseed protein, smoked fish, dry milk, chocolate candy.	Feces (stools, fecal swabs, filter paper wipes). Suspect foods; environmental swabs (if serotype). Pre-enrichment, selective enrichment, plating, screening, serotyping. Phage-typing. Typhimurium, Panama, Enteritidis, Infantis, and Thompson.	Chill foods rapidly in small quantities. Cook foods thoroughly. Pasteurize egg products and milk. Avoid cross-contamination from raw to cooked foods. Wash hands after touching raw meat. Sanitize equipment. Heat-treat feed and feed ingredients. Process meat and poultry in sanitary manner. Maintain farm sanitation. Practice personal hygiene. Protect food and feed from animal, human, bird, insect, and rodent excreta.
Typhoid Fever (Enteric fever) (11, 112, 176, 239, 275)	Similar to other salmonellae but adapted to human host. Possesses Vi (capsular) antigens as well as 0 and H antigens. Usually more than 10 <sup>8</sup> required to cause illness.	7 to 28 days, mean 14 days. In foodborne outbreaks, may be shorter incubation period. Septicemia and lymphoid tissue involvement. Malaise, headache, high persistent fever, cough, anorexia, nausea, vomiting, constipation, slow pulse rate, tender and distended abdomen, enlarged spleen, nose bleed, rose spots on chest and trunk, perspiration, chills, delirium, dulled sensorium, diarrhea, bleeding from bowel. Relapses occur. Slow convalescence of 1 to 8 weeks.	Feces and urine of infected humans. Carriers are important in transmission; some are longterm carriers. Water also involved in transmission; in such situations intragastric retention can be by-passed when drinking up to 50 ml water between meals, so fewer organisms can cause illness.	High protein foods, milk, shellfish. Cooked foods that have been handled and then eaten without further heat treatment.	Feces, urine, bile, gallstones, blood (during early course of illness), bone marrow. Suspect food, sewer swabs. Laboratory as above plus phage-typing. Demonstration of specific O agglutinins in blood or titer rise in convalescent serum.	Practice personal hygiene. Restrict carriers from handling food. Chill foods rapidly in small quantities. Cook foods thoroughly. Pasteurize milk. Age cheese 90 days. Harvest shellfish from unpolluted waters. Prepare and process food in sanitary manner. Protect and treat water. Dispose of sewage in sanitary manner. Immunize. Chloramphenicol therapy. Cholecystectomy frequently ends the carrier state.	

<sup>1</sup>Numbers within ( ) refer to references.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Paratyphoid Fever (Enteric fever) (111,239, 275)	<i>Salmonella enteritidis</i> serotypes Paratyphi A, Paratyphi B, Paratyphi C, Sendai, and any serotype (other than <i>S. typhi</i> ) that invades the blood stream and causes septicemia.	Similar to other salmonellae but more or less adapted to human host or capable of reaching blood stream.	7 to 15 days. Blood stream infection. Headache, profuse perspiration, nausea, vomiting, abdominal pain, enlarged spleen, diarrhea, sometimes rose spots. Similar but sometimes milder and of shorter duration (1 to 3 weeks) than typhoid fever.	Feces and urine of infected persons. Carriers sometimes involved in transmission.	Meat, poultry, eggs, milk, and their products. Other foods contaminated by sewage.	Feces, urine, blood. Suspect foods.  Laboratory as salmonellosis. Phage typing of Paratyphi B.	Chill foods rapidly in small quantities. Practice personal hygiene. Cook foods thoroughly. Pasteurize milk and eggs. Protect and treat water. Harvest shellfish from unpolluted waters; dispose of sewage in sanitary manner. Vaccine of questionable value in conferring immunity.
Arizonosis Infection (110,135)	<i>Arizona hinshawii</i>	Gram-negative, non-sporeforming motile rod. Similar to salmonellae. Delayed fermentation of lactose. Over 300 serotypes.	2 to 46 hours, usually 12 hours. Abdominal pain, diarrhea, nausea, chills, headache, weakness, fever. Lasts a few days.	Feces of infected persons and animals. Rep-tiles and turkeys are frequently infected.	Eggs, turkey, chicken, cream-filled pastry, ice cream, custard containing eggs.	Feces, suspect food.  Selective enrichment, plating, biochemical identification, serotyping.	Chill foods rapidly in small quantities. Cook foods thoroughly. Avoid cross contamination from raw to cooked food. Clean and sanitize equipment. Reheat leftover food thoroughly.
Staphylococcal Intoxication (Staphylo-enterotoxigenesis) (94,109, 119,208)	Toxins A, B, C, D, E, or F <i>Staphylococcus aureus</i> . Toxins elaborated in foods.	Gram-positive, non-sporeforming, non-motile cocci occurring in irregular, grape-like clusters. Aerobic, facultatively anaerobic; coagulase-positive; ferments mannitol; grows well in 10% salt media; produces lipase and hemolysin; often produces orange or yellow pigments. Frequently lysed by phage type group III. Resistant to many antibiotics. Toxin is protein (18 amino acids), heat stable. Less than 1 µg can cause illness.	1 to 7 hours, usually 2 to 4 hours. Sudden onset of nausea, excessive salivation, vomiting, retching, diarrhea, abdominal cramps, dehydration, sweating, weakness, prostration. Fever usually does not occur. Short duration of not more than a day or two.	Nose and throat discharges; hands and skin, infected cuts, wounds, burns; boils; pimples; acne; feces. Anterior nares of man are the primary reservoirs. Mastitic udders of cows and ewes. Arthritic and bruised tissues of poultry. Foods are usually contaminated after cooking by persons cutting, slicing, chopping or otherwise handling them and then kept at room temperature several hours or stored in large containers.	Cooked ham, meat products; poultry, and dressing; sauces and gravy; cream-filled pastry; potato, ham, poultry, fish salad, milk, cheese, bread pudding. High protein left-over food.	Vomitus, feces from ill. Nasal swab, pus from infected sores from food workers. Suspect food.  Organism: Selective enumeration, isolation, lipase (egg yolk) reaction, coagulase test, phage typing. Toxin: Extraction, concentration, gel diffusion.	Chill foods rapidly in small quantities. Prepare foods the day of serving, whenever possible. Restrict ill (diarrhea, colds, infected cuts) from work. Sanitize equipment. Thorough cooking, reheating, pasteurizing destroys the organism but not the toxin.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
<i>Clostridium perfringens</i> Gastro-enteritis (133,165, 172,173, 280)	<i>Clostridium perfringens</i> (weichi) type A. Large numbers of vegetative cells must be ingested. Enterotoxin (protein) released during sporulation in the gut.	Gram-positive, sporeforming, non-motile, encapsulated, short rod. Anaerobic. Produces lecithinase. Strains form either heat-resistant (some survive boiling for 1 to 5 hours) or heat-sensitive spores. Heating encourages spores to germinate. Approximately 90 known serotypes. Usually more than 10 <sup>6</sup> required to cause illness.	8 to 24 hours, median 12 hours. Acute abdominal pain, diarrhea. Occasional dehydration and prostration. Nausea, vomiting, fever and chills are rare. Short duration of 1 day or less.	Feces of infected persons and animals. Soil, dust, sewage. Both raw and cooked foods are frequently contaminated with <i>C. perfringens</i> . Foods are usually kept at room temperature, held warm (but not hot) for several hours, or stored in large containers in refrigerators.	Cooked meat or poultry, gravy, stew, and meat pies.	Feces, suspect food; environmental swabs (if serotype). Anaerobic isolation, selective enumeration, and egg yolk reaction, biochemical and microbiological identification, heat resistance evaluations, serotyping.	Chill food rapidly in small quantities. Prepare foods the day of serving whenever possible. Use clean pans for storage. Hold hot foods at 140F or above. Practice personal hygiene. Cure meats adequately. Dispose of sewage in sanitary manner. Thorough cooking will destroy vegetative cells but not heat-resistant spores. Reheat leftover food to 160F or above.
Enteritis Necrotic (Pig Bel, Darmbrand) (216)	<i>Clostridium perfringens</i> type C (formerly type F). Necrotoxin released during growth in gut.	Gram-positive, sporeforming, non-motile rod. Anaerobic. Produces lecithinase and necrotoxin. Strains differ in minor antigens.	6 hours to 6 days, usually 24 hours. Diarrhea, prolonged abdominal pain, gangrene of small intestine, shock, toxemia. Case fatality rate: 40%.	Animal feces. Malnutrition and diet may predispose people to attack. Cooked meat held without refrigeration for many hours. Only two reported outbreaks.	Pork, other meat, fish.	Feces, bowel contents, blood, suspect food. Anaerobic isolation, identification, toxin testing.	Eat balanced diet. Chill foods rapidly in small quantities. Thorough cooking will destroy vegetative cells but not heat-resistant spores. Reheat leftover food to >160F. Hold hot food at >140 F.
<i>Bacillus cereus</i> Gastro-enteritis (151,155)	Emetic or diarrheagenic exo-enterotoxins of <i>Bacillus cereus</i> . Toxins elaborated in foods.	Large, Gram-positive, sporeforming, motile rod, frequently forms chains. Produces lecithinase. Diarrheagenic thermolabile toxin (139F for 20 min.). Emetic thermostable toxin (survive 259° for 90 min.). Probably very large numbers (>10 <sup>6</sup> ) required to cause illness.	1/2 to 5 hours. Nausea and vomiting, (similar to staphylococcal intoxication), sometimes diarrhea. Short duration of 1 day or less. 8 to 16 hours. Nausea, abdominal cramps, watery diarrhea. Short incubation of 1 day or less.	Soil and dust. Foods are usually kept at room temperature, held warm (but not hot) for several hours, or stored in large containers in refrigerators.	Boiled rice and fried rice. Custards, cereal products, puddings, sauces, vegetable dishes and soups, meat loaf.	Feces, vomitus. Suspect foods. Selective isolation and identification, serotyping.	Chill foods rapidly in small quantities. Hold hot foods at 140F or above. Avoid room temperature storage. Process and prepare food in sanitary manner. Reheat leftover food to 160F. Use clean pans for storage.

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Botulism (174, 204, 234, 258, 274)	Toxins A, B, E, or F of <i>Clostridium botulinum</i> . Toxins C and D cause botulism in animals. Type G has not yet caused any human cases. Toxin elaborated in foods, wounds or infant gut.	Gram-positive, sporeforming, motile rod. Anaerobic. Produces neurotoxins that interfere with acetylcholine at peripheral nerve endings. Spores are among the most heat resistant. Toxins are simple proteins and are heat labile.	2 hours to 6 days, usually 12 to 36 hours. Nausea, vomiting, abdominal pain, and diarrhea may appear early. Headache, vertigo or dizziness, lassitude, double vision, loss of reflex to light, dysphagia, dysphonia, ataxia, dry mouth, weakness, constipation, respiratory paralysis. Partial paralysis may persist 6 to 8 months. Sensorium usually clear. Case fatality rate: 35 to 65%. Fatal 3 to 10 days.	Soil, mud, water, intestinal tract of animals. Spores widely distributed in soil, but type varies with location.	Improperly canned low-acid food (green beans, corn, beets, asparagus, chili peppers, mushrooms, spinach, figs, olives, tuna). Smoked fish. Fermented foods (seal flippers, salmon eggs). Food stored in oil or vacuum-packed also involved. Improperly home-cured hams.	Blood serum, feces, stomach contents, autopsy tissue. Suspect food. Food: (Toxin) - mouse neutralization. Serum and feces: Mouse neutralization. History of eating canned or vacuum-packed food useful in diagnosis.	Heat containers of low-temperature under pressure for sufficient time. Cook home-canned food thoroughly (boil and stir for 15 min.). Acidify food. Keep food refrigerated. Cure in sufficient concentration of salt. Add sufficient nitrite to pasteurized meat products. Discard swollen cans. Bivalent A-B and monovalent E A-B-C-D-E-F antitoxin available for treatment.
Campylobacteriosis (Campylobacter jejuni)	<i>Campylobacter jejuni</i> (Vibrio fetus)	Gram negative, motile, comma-shaped organism. Forms spirals. Microaerophilic. 10 <sup>6</sup> required to cause illness in single volunteer trial.	1 to 7 days, usually 3 to 5 days. Diarrhea (stools often foul smelling, bile stained, watery or mucoid or bloody), abdominal pain, fever, anorexia, malaise, headache, myalgia, nausea, vomiting, arthralgias. Duration 1 to 5 days.	Intestine, liver, and gallbladder of cattle, sheep, pigs, poultry(?), and other animals. Contact with infected animals or their tissues another mode of transmission. Waterborne outbreaks documented.	Raw milk, raw beef liver and meat, poultry(?) water.	Blood, feces, suspect food. Isolation (10% CO <sub>2</sub> ), identification, serology.	Cook meat thoroughly. Pasteurize milk. Chill foods rapidly in small quantities, avoid cross contamination from raw foods of animal origin.
Scombroid (Histamine Poisoning) (65, 83)	<i>Scobrototoxin</i> , histamine, and probably related or synergistic substance(s), or potentiating conditions. Histamine precursor or antilog. Enterobacteriaceae, particularly <i>Proteus</i> , and pseudomonads, clostridia, streptococci, and others.	Histidine in flesh decarboxylated by action of <i>Proteus</i> spp. or other bacteria. The two stable (boiling for 1 hour). Histamine is a capillary dilator.	Few minutes to 1 hour. Metallic, sharp, or peppery taste. Intense headache, dizziness, facial swelling and flushing, epigastric pain, throbbing of carotid and temporal vessels, rapid and weak pulse, burning of throat, thirst, difficulty in swallowing, edema, itching of skin, audible wheezing, diarrhea. Generalized erythema and urticarial eruptions over entire body. Recovery within 12 hours.	Flesh of scombroid fish or certain other fish on or in which bacteria that possess a histidine decarboxylase multiply when fish improperly refrigerated.	Scombroid fish (tuna, bonito, mackerel, skipjack). Blue dolphin (mahimahi).	Vomitus, feces, fish. Bacterial isolation and identification. Extraction, separation, fish with sharp or peppery taste. Fluorimetry. Intramuscular injection of guinea pigs and ileum loops. Fluorimetric assay.	Ice or refrigerate fish soon after capture and maintain cold temperature until cooked. Eat fish soon after caught. Discard separation, fish with sharp or peppery taste. Treat with antihistamine.



DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
<i>Vibrio parahaemolyticus</i> Gastro-enteritis (85,98, 209,242)	<i>Vibrio parahaemolyticus</i>	Gram-negative, straight or curved, motile rod. Aerobic facultatively anaerobic. Halophilic (1-7% but not 10% NaCl). Possesses O, K, and H antigens. Usually 10 <sup>5</sup> -10 <sup>7</sup> required to cause illness.	2 to 48 hours, usually 12 hours. Abdominal pain, diarrhea (watery stools containing mucus), usually nausea and vomiting, mild fever, chills, headache, prostration. Recovery within 2 to 5 days.	Sea water and marine life. Most illnesses have been reported in Japan and in the warmer months.	Raw foods of marine origin. Saltwater fish, mollusks, crustaceans, and fish products. Cucumbers and salty foods have been implicated (following cross contamination)	Feces. Suspect food. Selective (3% salt) isolation, identification from raw sea foods. Sanitize equipment. Avoid using sea water for rinsing food to be eaten raw or for cleaning.	Cook seafoods thoroughly. Chill food rapidly in small quantities. Prevent cross-contamination from raw sea foods. Sanitize equipment. Avoid using sea water for rinsing food to be eaten raw or for cleaning.
Cholera (16,88,150, 232,242,261)	<i>Vibrio cholerae</i> and <i>V. cholerae</i> biotype El Tor, either Inaba or Ogawa serotypes. Enterotoxin (exotoxin) elaborated in small intestine.	Gram-negative, motile, curved rod. Aerobic. High alkalinity (9-9.6) growth tolerance. El Tor biotype is hemolytic. Heat-labile enterotoxin mediates movement of water and ions from tissues into lumen of bowel and results in outpouring of isotonic fluid. Unless gastric acid decreased or neutralized, 10 <sup>6</sup> required to cause illness.	2 to 3 days. Sudden onset, profuse watery diarrhea containing mucus (rice-watery stools), abdominal pain, rapid dehydration and collapse, cold and clammy skin, drawn and withered face and hands, intense thirst, hoarseness, faintness, muscular cramps in extremities. Appearance of victim: sunken eyes, prominent cheekbones, washerwoman hands, skin turgor. 50 to 75% can die without proper treatment; <1% if given oral or intravenous rehydration.	Can be found in sea-water probably from human sewage. Fish and shellfish can serve as reservoir. Feces and vomitus of infected humans, persons incubating the disease, and convalescents. Persons with impaired gastric acid production and malnourished persons more susceptible. Not related to chicken or hog cholera. Endemic in Indo-Pakistan subcontinent. Sometimes waterborne.	Raw mussels, shrimp, fish, cucumbers, possibly raw vegetables, mixed and moist foods. Foods made up of or washed or sprinkled with contaminated water; food prepared in utensils rinsed in contaminated water; foods that receive no further heating; foods handled by infected persons (hors d'oeuvres).	Feces, vomitus, serum, suspect food, water. Alkaline enrichment, plating, serotyping, phage typing. Test for specific agglutinins in blood.	Dispose of sewage in sanitary manner. Protect and treat water. Practice personal hygiene. Cook foods thoroughly. Chill foods rapidly in small quantities. Immunization provides incomplete protection.
Non-O1 <i>Vibrio</i> Gastro-enteritis (98)	Exotoxin of non-O1 <i>Vibrio</i> (Enteritides) (See <i>V. fluvialis</i> , <i>V. holisae</i> , and <i>V. mimicus</i> ).	Gram-negative, curved rod, identical or similar to <i>V. cholerae</i> but has different antigenic structure.	2 to 3 days. Watery diarrhea, abdominal cramps, nausea, vomiting, dehydration, anuria. Varies from loose stools to cholera-like disease. Duration 2 days.	Sea water and sea life. May be other sources.	Pickled herring, chopped egg on asparagus, shellfish.	Feces, suspect food. Alkaline enrichment, plating, identification, agglutination.	Dispose of sewage in sanitary manner. Protect and treat water. Practice personal hygiene. Cook foods thoroughly. Chill food rapidly in small quantities.

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Bongkreik Poisoning (110,277)	Toxins (toxoflavin and bongkreikic acid) of <i>Pseudomonas cocovenenans</i>	Gram-negative rod. Depending on culture medium, grows in different cell and colony forms and colony color. Produces heat-stable, unsaturated, fatty acid (bongkreik acid) that interferes with carbohydrate metabolism.	Hyperglycemia followed by hypoglycemia (low glucose level in blood), severe spasms, unconsciousness, and death. High case fatality rate.	<i>P. cocovenenans</i> overgrows <i>Rhizopus</i> mold responsible for fermentation only when the mold grows very poorly. The well-fermented product has never been shown to be toxic. Reported only in Central Indonesia.	Poorly fermented bongkreik (pressed or grated coconut).	Blood. Suspect poorly fermented coconut. Isolation and identification.	Warn local population against ingesting poorly fermented bongkreik. Lower pH of product.
Shigellosis (Bacillary dysentery) (16,110, 134,285)	<i>Shigella sonnei</i> , <i>S. flexneri</i> , <i>S. dysenteriae</i> , <i>S. boydii</i>	Gram-negative, non-motile rod. Aerobic, facultatively anaerobic. Similar to <i>Escherichia coli</i> but does not ferment lactose. Relatively fragile. More than 30 serotypes. As few as 10 <i>S. dysenteriae</i> and 100 <i>S. flexneri</i> have caused illness in human volunteers.	1 to 7 days, usually less than 4 days. Extremely variable, mild to severe symptoms: Abdominal cramps, fever, chills, diarrhea, watery stools (frequently containing blood, mucus, or pus), tenesmus, lassitude, prostration, nausea, vomiting, dehydration.	Usually Transmitted by Other Means, but Sometimes Foodborne  Feces of infected persons. Main mode of transmission: person-to-person. Also waterborne. Carriers shed organism for few weeks to 2 months or longer.	Moist, mixed food. Potato, tuna, shrimp, turkey, and macaroni salads, milk, beans, apple cider, and poi reported	Feces, suspect food. Enrichment (foods), selective isolation, biochemical identification, serotyping of groups other than <i>Sonnei</i> .	Practice personal hygiene. Dispose of sewage in sanitary manner. Chill foods rapidly in small quantities. Prepare food in sanitary manner; avoid touching foods which are not subsequently cooked. Cook foods thoroughly. Protect and treat water. Control flies.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
<i>Escherichia coli</i> Diarrheas (9,16,110, 240)	<i>Escherichia coli</i> <sup>2</sup> Both enterotoxigenic and invasive strains cause illness. Both heat-stable and heat-labile enterotoxins produced.	Gram-negative, non-sporeforming rod. Aerobic, facultatively anaerobic. Ferments lactose. Indole positive, methyl red positive, Voges-Proskauer negative, citrate negative. Possesses O, 90 K, and 50 H antigens. Usually more than 10 <sup>8</sup> required to cause illness.	8 to 24 hours, mean 11 hours (invasive type). Fever, chills, headache, myalgia, abdominal cramps, profuse watery diarrhea. Similar to shigellosis. 8 to 44 hours, mean 26 hours (enterotoxigenic type). Diarrhea (rice-water stools), vomiting, dehydration, shock. Similar to cholera.	Feces of infected persons. Possible modes of transmission: Person-to-person, airborne and waterborne. Infants are more susceptible. Possibly important cause travellers' diarrhea.	Cheese, coffee substitute, salmon (?).	Feces, throat swabs, blood from ill, suspect food. Selective enrichment, bioplotting, biochemical identification. Toxin testing of ligated ileum, suckling infant mice, and adrenal tumor cells. Invasiveness tested by inoculation in guinea pig eye and observe for keratoconjunctivitis and by HeLa cells culture.	Chill foods rapidly in small quantities. Cook and reheat foods thoroughly. Practice personal hygiene. Prepare foods in sanitary manner. Protect and treat water. Dispose of sewage in sanitary manner.
Beta-hemolytic Streptococcal Infections (Scarlet Fever, Septic Sore Throat) (106,110, 171)	<i>Streptococcus pyogenes</i>	Gram-positive, non-motile, microaerophilic cocci in chains. Produces beta hemolysis (wide zone of complete hemolysis around colonies on blood agar). Lansfield's Group A and G streptococci. Over 40 antigenic types within Group A.	1 to 3 days. Sore and red throat, painful swallowing, tonsillitis, high fever, headache, nausea, vomiting, malaise, rhinorrhea. Occasionally a rash occurs.	Infected persons. Nose, throat, and lesion discharges. Main mode of transmission: Airborne.	Milk, ice cream, eggs, steamed lobster, potato shrimp, tuna, and egg salads, custard and pudding. Foods usually contain eggs or milk.	Nasal and throat swabs, pus, sputum from workers. Suspect food; environmental swabs (if serotype). Isolation, hemolytic (blood agar) reaction, serotyping.	Chill foods rapidly in small quantities. Practice personal hygiene. Cook foods thoroughly. Pasteurize milk. Exclude workers suffering from respiratory illness or skin lesions from handling food.

<sup>2</sup>Serogroups that have caused the invasive-type illness are 025, 028, 0112, 0124, 0136, 0143, 0144, 0147, and 0512; those that have been shown to elaborate enterotoxins are 006, 015, 018, 020, 027, 044, 055, 078, 086, 0111, 0114, 0119, 0125, 0126, 0127, 0128, 0142, 0146, 0148, 0154, 0155, and 0156.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Yersiniosis ( <i>Yersinia enterocolitica</i> , <i>Y. pseudotuberculosis</i> Enteritis) (8,102,110, 213,222)	<i>Yersinia enterocolitica</i> , <i>Yersinia pseudotuberculosis</i>	Gram-negative, motile rod. Coccoid forms predominate in young cultures. Aerobic, facultatively anaerobic. Psychrotrophic. About 10 <sup>9</sup> caused illness in volunteers.	24 to 36 hours and longer. Abdominal pain suggesting acute appendicitis, fever, headache, malaise, anorexia, diarrhea, vomiting, nausea, chills, pharyngitis, leukocytosis, erythema nodosum.	Urine and feces of infected animals frequently rodents, dogs, pigs, chickens. Found in soil, dust, and water. Waterborne transmission.	Pork and other meat, raw milk, chocolate milk.	Feces, blood, suspect food, animal tissue. Lymph nodes. Cold enrichment, isolation, identification. Determine specific agglutinins in blood. Animal inoculations.	Cook foods thoroughly. Protect food from cross contamination. Control rodents. Rapid chilling and refrigeration increases lag and slows growth but may have a selective effect.
Brucellosis (11,110, 263)	<i>Brucella melitensis</i> , <i>B. abortus</i> , or <i>B. suis</i>	Gram-negative, encapsulated, non-motile, coccoid to rod-shaped cells. Aerobic, but <i>B. abortus</i> required CO <sub>2</sub> .	5 to 21 days. May be several months. Insidious onset. Fever, chills, sweating, insomnia, weakness, malaise, headache, muscle and joint pain, loss of weight, anorexia.	Tissue, blood, placenta, urine, milk, vaginal discharge, and aborted fetus of infected animals (cattle, sheep, swine, goats, and horses). Main mode of transmission: Contact with infected tissues.	Raw milk, cheese made of raw goat milk.	Blood, bone marrow, milk, urine, animal tissue (see source). Isolation, identification, biochemical typing, animal inoculations, serology. Test for specific agglutinins in blood.	Eradicate brucellosis from livestock (immunize young animals, restrict movement, test, segregate or slaughter infected animals). Cook food thoroughly. Pasteurize milk and dairy products. Age cheese for at least 90 days.
Tuberculosis (110,144, 205,293)	<i>Mycobacterium tuberculosis</i> and <i>M. bovis</i>	Gram-positive, non-motile, acidfast rod. Aerobic. Contains waxy substance (resistant). Grows slowly (>18-hour generation time).	Variable. Several weeks. Cervical or mesenteric lymph node involvement. Skeletal tuberculosis: Pain, limp, refusal to walk, restriction of movement, night cries, fatigue, weight loss. Tuberculosis endarteritis in growing bone progressing into joint space. Bone destruction leading to collapse spinal deformity, paraplegia. Necrosis of joints and soft tissues form paravertebral cold abscesses. Spine, hip, and knees most frequently involved.	Respiratory secretions of man; milk from diseased cattle. Main mode of transmission: Airborne. Ingestion of bacilli is probably unimportant, except for milk under grossly insanitary conditions in areas of high prevalence of TB. Milkborne transmission is rare today.	Raw milk.	Sputum, gastric washings, joint fluids, lymph nodes, blood, urine, bone biopsy, suspect food. Isolation, acid-fast staining, identification, animal inoculations, drug susceptibility testing.	Eradicate tuberculosis in animals (test and slaughter reactors). Pasteurize milk. Isolate and treat cases. Immunize with BCG in high prevalence areas.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
Nitrite Poisoning (Methemoglobinemia) (141,253)	Nitrite reduced from nitrate by Enterobacteriaceae, staphylococci, Pseudomonas, S. subtilis, C. perfringens	Reduces nitrates to nitrites.	Few hours. Vomiting, cyanosis (blueness of lips and fingers), fall in blood pressure, loss of consciousness.	Excessive nitrification of fields. Occurs in children. Moist foods stored at room temperature.	Spinach	Blood	Do not harvest produce shortly after nitrification. Refrigerate foods. Chill cooked rapidly in shallow containers.
Diphtheria (87,110)	Cornebacterium diphtheriae	Gram-positive, non-motile, pleomorphic rod. Frequently club-shaped swellings possessing chromatogenic granules. Cells usually form a palisade. Aerobic, facultatively anaerobic. Toxicogenic strains carry a lysogenic phage.	2 to 5 days, sometimes longer. Insidious onset. Inflammation of throat and nose, spreading, grayish exudate of membranous character on uvula, palate, pharyngeal wall, and nostrils. Fever, chills, sore throat, malaise, difficulty swallowing, edema of pharynx, enlarged cervical lymph nodes, prostration. Yellow, blood-stained discharge from nose. Albuminuria and hematuria.	Obligate parasite of man (case, convalescent, carrier). Discharges and secretions from mucous surfaces of nose, pharynx, and nasopharynx. Skin and other lesions of man. Main mode of transmission: Airborne. Milkborne transmission is rare today.	Raw milk, ice cream.	Throat and nose swabs, blood, milk. Isolation, staining, identification, toxigenicity test.	Immunize. Pasteurize milk. Prevent contamination by humans after heat treatment of milk. Practice personal hygiene. Isolate cases.
Tularemia (110,244)	Francisella tularensis	Gram-negative, non-motile, pleomorphic rod. Aerobic. Survives quite well at low temperatures. Can penetrate unbroken skin. 10% can cause illness by respiratory or intradermal routes.	8 to 24 hours or longer. Ulcer forms at site of pathogenic invasion. Chills, high fever, prostration, stupor, coma; swollen, tender, suppurative lymph nodes. Course of illness may be fulminant and fatal.	Source: Blood and tissue of infected mammal or infected arthropod. Reservoir: Wild animals, frequently rabbits, wood ticks, Main mode of transmission: Contact with infected tissue. Also transmitted by insect bites and drinking water. Rarely transmitted by food.	Rabbit meat.	Rabbits, Blood, lymph nodes, muscle and other tissues. Meat. Isolation, agglutination reaction, serology. Demonstrate specific agglutinins in blood.	Cook meat of wild rabbits thoroughly. Use rubber gloves when dressing rabbits. Wear protective clothes and use tick repellent in endemic areas.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORG/ANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Q Fever (Query Fever) (110,197)	<i>Coxiella</i> ( <i>Rickettsia</i> ) <i>burnetii</i>	Gram-negative, small, pleomorphic, nonmotile rod, frequently occurring in pairs. Obligately intracellular parasite occurring as clumps and masses within cytoplasm. Markedly resistant to desiccation. Resists 60C for 1 hour.	2 to 4 weeks, mean 20 days. Sudden onset, chills, headache, weakness, malaise, severe sweats, high fever, pneumonia, mild cough, chest pain.	Tick (feces), wild animals, cattle, sheep, and goats. Dust and aerosols from animals. Placental tissue, fetal membranes, amniotic fluid and milk are frequent sources. Other sources: Bodies of patients, carcasses, wool, straw, laundry, alf. More commonly transmitted by inhalation of aerosols.	Milk (rarely transmitted by this source).	Blood, sputum, urine, cerebrospinal fluid, postmortem tissues, milk. Animal inoculation, serology, isolation.	Pasteurize milk at 145F for 30 minutes or 161F for 15 seconds. Practice personal hygiene (animal workers). Vaccinate animals before shipping to areas having infected animals. Separate pregnant animals for parturition and 3 weeks thereafter. Dispose of placentae and fetal membranes so animals have no access to them.
Anthrax (Intestinal) (105,110)	<i>Bacillus anthracis</i>	Gram-positive, non-motile, spore-forming, encapsulated, large rods which frequently form long chains. Aerobic, facultatively anaerobic. Morphologically and biochemically resembles <i>B. cereus</i> .	2 to 3 days. High fever, general weakness, malaise, headache, insomnia, nausea, abdominal pain, vomiting (containing bile and blood), diarrhea; progressing through general toxemia, shock, cyanosis, and death. Gastrointestinal anthrax is frequently fatal.	Tissue, hide, and feces of infected animals. Soil contaminated by infected animals. Main mode of transmission: Contact with infected animals or contaminated hides or materials. Rarely transmitted by food.	Raw or undercooked meat and sausage.	Blood, sputum, autopsy tissue (lymph nodes), animal tissue, environmental swabs, suspect food, soil. Isolation, identification, microscopic examination, animal inoculations.	Cook foods thoroughly. Animal postmortem inspection. Isolation of sick animals. Dispose of carcasses to avoid contamination. Vaccinate healthy animals.
Haverhill Fever (110)	<i>Streptobacillus moniliformis</i>	Gram-negative, non-sporeforming, pleomorphic rods forming chains. Tends to fragment into irregular, bacillary and coccobacillary elements. Requires ascitic fluid or blood for growth. Aerobic, facultatively anaerobic.	1 to 5 days. Rash. Swollen, red, and painful joints. Sore throat.	Nasopharynx of rats. Main mode of transmission: rat bites. One documented food-borne outbreak.	Raw milk.	Blood, joint fluid, pus, animal saliva, suspect food.	Pasteurize milk. Control rodents.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Disease in Which Proof of Transmission by Foods Is Inconclusive							
Fecal Streptococcus	<i>Streptococcus faecalis</i> and <i>S. faecium</i>	Gram-positive cocci in chains. Grows in 6.5% NaCl at pH 9.6 at 50F, at 113F. Withstands 140F for 30 minutes. Alph-, beta-, or non-hemolytic. Lansfield's Group D streptococci. 10 <sup>9</sup> -10 of a few strains of <i>S. faecalis</i> required to cause illness.	2 to 36 hours, usually 6 to 12 hours. Nausea, abdominal pain, diarrhea, sometimes vomiting. Relatively milk and similar to <i>C. perfringens</i> foodborne illness.	Feces of animals and man.	Sausage, evaporated milk, meat croquettes, meat pies, pudding.	Feces, suspect food. Selective enumeration, identification, test for Sherman's criteria, serogrouping.	Chill foods rapidly in small quantities. Cook foods thoroughly. Practice personal hygiene. Prepare food in sanitary manner.
Proteus Gastro-enteritis (110,134)	<i>Proteus vulgaris</i> <i>P. mirabilis</i> <i>P. morganii</i> and <i>P. rettgeri</i> (staphylococcal enterotoxin?)	Gram-negative, motile rod. Aerobic, facultatively anaerobic. Produces urease.	3 to 5 hours. Diarrhea, vomiting, abdominal cramps. (Also see scrembroid poisoning.)	Feces of animals and man.	Headcheese, ham, cheese, spaghetti. (See scrembroid poisoning.)	Feces, suspect food. Isolation, identification, hygiene.	Chill foods rapidly in small quantities. Cook foods thoroughly. Practice personal hygiene.
Providencia Gastro-enteritis (110,134)	<i>Providencia alcalifaciens</i> and <i>P. stuartii</i> ( <i>Proteus inconstans</i> )	Gram-negative, motile rod. Aerobic, facultatively anaerobic.	2 to 24 hours. Diarrhea, vomiting, abdominal cramps.	Feces of animals and man.	Chicken.	Feces, suspect food. Isolation, identification, serotyping.	Chill foods rapidly in small quantities. Cook foods thoroughly. Practice personal hygiene.
Klebsiella Enteritis (110,134)	<i>Klebsiella pneumoniae</i> , <i>K. ozaenae</i> , and <i>K. rhinocleromatis</i>	Gram-negative, non-motile, encapsulated rod. Aerobic facultatively anaerobic. Enterotoxin detected.	10 to 15 hours. Headache, dizziness, nausea, abdominal pain, watery stools.	Feces of animals and man. Respiratory tract of man.	Beef, rice.	Feces, suspect food. Isolation, identification, serotyping.	Chill foods rapidly in small quantities. Cook foods thoroughly. Practice personal hygiene.
Citrobacter Gastro-enteritis (110,134)	<i>Citrobacter freundii</i> (formerly <i>Escherichia freundii</i> ) <i>C. intermedium</i> Bethesda-Ballrup Group.	Gram-negative, motile rod. Aerobic, facultatively anaerobic. Citrate positive, collagenogenes organism. Some anti-Salmonella, Arizona, <i>E. coli</i> .	1 to 48 hours, median 12 hours. Diarrhea, abdominal cramps, nausea, vomiting, fever, chills, dizziness.	Feces of animals and man.	Corn pudding, raw milk, macaroni with meat, liver sausage, smoked meat.	Feces, suspect food. Isolation, identification, serotyping.	Chill foods rapidly in small quantities. Cook foods thoroughly. Practice personal hygiene.

CONTROL MEASURES

SPECIMENS/  
LABORATORY

FOODS INVOLVED

SOURCE, RESERVOIR  
AND EPIDEMIOLOGY

INCUBATION PERIOD/  
SIGNS AND SYMPTOMS

NATURE OF  
ORGANISM/TOXIN

ETIOLOGIC  
AGENT

DISEASE

Enterobacter Gastro- enteritis (110,134)	Enterobacter (Aerobacter) cloacae, <i>E. aerogenes</i> , <i>E. hafniae</i> , and <i>E. liquefaciens</i>	Gram negative, (usually) non- motile rod. Aero- bic, facultatively anaerobic. Entero- toxin detected.	2 to 6 hours. Diarrhea, nausea, vomiting, abdominal pain.	Feces of animals and man.	Cream-filled pastry, milk, stew.	Feces, suspect food. Isolation, identification.	Chill foods rapidly in small quantities. Cook foods thoroughly Practice personal hygiene.
Edwardsiella Enteritis (110,134, 139)	<i>Edwardsiella tarda</i>	Gram-negative rod. Aerobic, facultat- ively anaerobic.	Abdominal cramps, diarrhea.	Feces of animals (particularly snakes, other reptiles, seagulls, seals) and man.		Feces, suspect food. Isolation, identification.	Chill foods rapidly in small quantities. Cook foods thoroughly Practice personal hygiene.
<i>Vibrio vulnificus</i> Septi- cemia (97,98)	<i>Vibrio vulnificus</i>	Gram-negative, motile, curved rod. Ferments lactose.	<24 hours, median 16. Malaise, chills, fever, prostration, sometimes vomiting and diarrhea, hypotension. Meta- static cutaneous lesions (erythematous or ecchymotic areas on extremities, vesicles formed and necrotic ulcers) within 36 hours. Death frequently occurs.	Sea water. Fre- quently pre-existing hyponic disease. Wound infections also occur in warmer months.	Raw oysters.	Blood, infected tissues. Isolation, identification.	Cook seafood thoroughly.
<i>Vibrio mimicus</i> Diarrhea (127)	<i>Vibrio mimicus</i>	Gram-negative, motile, vibrio similar to <i>V. cholerae</i> but does not fer- ment sucrose, oxidase-positive, VP negative. Produces heat- labile entero- toxin.	Diarrhea	Sea water, shell- fish, marine crustacea	Shellfish	Feces, suspect food. Isolation, identification, serotyping, antibiograms, enterotoxin assay.	Cook seafood thoroughly. Chill food rapidly in small quantities. Avoid cross- contamination.
<i>Vibrio fluvialis</i> Diarrhea (196)	<i>Vibrio fluvialis</i> (Group EF-6 and F)	Gram-negative motile vibrio similar to <i>aeromonas</i> and vibrios, ferments sucrose.	Diarrhea (fre- quently containing blood and pus), vomiting, abdominal pain, dehydration, fever.	Sea water, river water, shellfish, and marine crustacea.	Unknown (seafood?)	Feces, suspect food. Isolation, identification, serotyping, antibiograms.	Chill foods rapidly in small quantities. Cook seafood thoroughly.
<i>Vibrio holisae</i> Diarrhea (168)	<i>Vibrio holisae</i>	Gram-negative motile vibrio. Halophilic.	Diarrhea			Feces, suspect food. Isolation, identification.	Chill foods rapidly in small quantities. Cook food thoroughly.



DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
<i>Pseudomonas aeruginosa</i> Gastro-enteritis (110,131, 294)	<i>Pseudomonas aeruginosa</i>	Gram-negative, motile rod. Aerobically facultatively anaerobic. Produces pyocyanin and fluorescein. Forms blue pus in infections. Highly resistant to most common antimicrobial agents and disinfectants. Heat-labile and heat-stable enterotoxins detected.	Few days. Diarrhea, abdominal cramps, nausea, vomiting, dehydration, cyanosis.	Skin lesions, feces of man, water, sewage, soil, vegetables. Also transmitted via hospital environment.	Milk, rabbit, syrup, human milk,	Feces, urine, pus, suspect food.	Chill foods rapidly in small quantities. Pasteurize milk. Cook food thoroughly. Practice personal hygiene. Avoid cross contamination from raw foods. Thorough cleaning of kitchen equipment.
<i>Aeromonas Enteritis</i> (110,278)	<i>Aeromonas hydrophila</i> , <i>A. salmonicida</i> , <i>A. punctata</i>	Gram-negative rod. Aerobic, facultatively anaerobic. Enterotoxins detected.	Diarrhea, abdominal pain, fever.	Water, frogs, fish.	Salt mackerel, fish, water.	Feces, water, suspect food. Enrichment, plating, separation from enterics by oxidase test, biochemical identification.	Chill foods rapidly in small quantities. Cook foods thoroughly. Treat and disinfect water supplies.
<i>Plesiomonas Enteritis</i> (110)	<i>Plesiomonas shigelloides</i>	Gram-negative rod. Aerobic, facultatively anaerobic. Possesses two common antigens with <i>Shigella</i> . Enterotoxins detected.	Diarrhea, abdominal pain, fever.	Water, fish.		Feces, suspect food. Enrichment, plating, separation from enterics by oxidase test, biochemical identification.	Chill foods rapidly in small quantities. Cook foods thoroughly. Treat and disinfect water supplies.
<i>Bacillus subtilis</i> Gastro-enteritis (110,152)	<i>Bacillus subtilis</i>	Gram-positive, sporeforming, motile rod. Aerobic. Sometimes confused with <i>B. cereus</i> because of morphological and biochemical features.	Average 10 hours, some reports; others 15 to 60 minutes. Diarrhea, abdominal cramps, nausea, prostration, vomiting, feeling of feverishness.	Soil and decomposing organic matter.	Fish, turkey, sausage rolls, liver sausage, pickled fish.	Feces or vomitus, suspect food, environmental swabs. Isolation, identification.	Chill foods rapidly in small quantities.
<i>Bacillus brevis</i> Gastro-enteritis (152)	<i>Bacillus brevis</i>	Gram-positive, sporeforming rod.	1 to 10 hours. Vomiting and diarrhea.	Soil and air.		Vomit, feces. Isolation, identification.	Chill foods rapidly in small quantities.

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Bacillus licheniformis Gastroenteritis (152)	Bacillus licheniformis	Gram-positive, sporeforming rod.	8 to 12 hours. Diarrhea, vomiting, abdominal cramps, prostration.	Soil and air.	Ground meat.	Feces, blood, suspect food. Isolation, identification.	Chill foods rapidly in small quantities. Hold hot food at 140F or above.
Clostridium bifermentans Diarrhea (110)	Clostridium bifermentans	Gram-positive, motile, anaerobic rod.	6 to 7 hours. Diarrhea.	Soil.	Potato pie.	Feces. Isolation, identification	Chill foods rapidly in small quantities. Reheat foods thoroughly. Hold hot foods at 140F or above.
Alcaligenes faecalis Gastroenteritis (110)	Alcaligenes faecalis (E. coli?)	Gram-negative, motile, aerobic, coccoid rod.	6 to 33 hours, average 21 hours. Abdominal cramps, diarrhea, vomiting, thirst, headache, dehydration, pyrexia, myalgia.	Soil, vegetation.	Meat, poultry.	Feces. Isolation, identification	Chill foods rapidly in small quantities. Protect cooked foods from contamination.
Actinomyces Gastroenteritis (?) (110)	Actinomyces-like organism. (Staphylococcal intoxication or Ichthyotoxism?)	Branched forms that break into small coccoid segments.	1 hour. Diarrhea, vomiting, abdominal cramps, prostration.	Unknown. Only one reported outbreak.	Roe.	Feces, suspect food. Isolation, identification.	Cook foods thoroughly. Protect food from contamination. Chill food rapidly in small quantities.
Listeriosis (110, 249)	Listeria monocytogenes	Gram-positive, motile rod. Aerophilic. Grows well in 10% NaCl media and survives in 20%. Beta hemolytic grows well at 39F. Survives 176F for 5 minutes.	Unknown. Probably 4 days to 3 weeks. Fever, headache, nausea, vomiting, monocytosis, meningitis, septicemia, abortion, localized external or internal lesions, pharyngitis.	Tissues, urine, or milk of infected animals.	Milk, possibly milk products (cream, sour milk, cottage cheese), eggs, meat, poultry.	Animal tissue, milk, suspect food, blood, urine, cerebrospinal fluid, placental tissue, autopsy tissue. Isolation, identification, production of keratoconjunctivitis in rabbit's eyes, serology.	Cook foods thoroughly. Pasteurize milk.
Acetobacter melanogenus Intoxication (110)	Products produced by Acetobacter melanogenus	Gram-negative, motile or non-motile rod. Strict aerobes that oxidize ethanol to acetic acid.	Abdominal pain, nausea, vomiting, black tarry stools.	Contaminant of yeast.	Homemade lager.	Feces, vomitus, suspect food. Isolation and identification.	Control fermentation of beer.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
Unknown Role in Foodborne Transmission (Pathogenic and Isolated From Foods)							
Mycobacteria Infections (110, 117, 293)	<i>Mycobacteria</i>	Acid-fast rod. Aerobic. Contains waxy substance (resistant). Non-photochromogenic. Resists destruction by conventional pasteurization.	Variable. Several weeks.	Infected animals, soil (?).	Unknown, possibly milk (?)	Suspect food, blood. Laboratory: See Tuberculosis.	Increase pasteurization temperatures.
Erysipeloid (110)	<i>Erysipelothrix insidiosa</i> , <i>E. erysipeloides</i> , and <i>E. rhusiopathiae</i>	Gram-positive, non-motile rod with tendency to form long filaments. Microaerophilic, facultative. Resistant to salting, pickling, and smoking.	Few hours. Malaise, generalized pruritus, redness, swelling and itching of infected areas, anemia. Septicemia may develop.	Infected animals and fish. Primarily an occupational disease of persons handling these animals or their meat.	Possibly poultry, fish, meat, salted pork (?)	Suspect food, biopsy tissue. Isolation, identification.	Cook foods thoroughly. Avoid cross contamination. Thorough cleaning of meat and fish processing equipment.
Leptospirosis (110)	<i>Leptospira</i>	Spirochetes with fine coiling of their primary spirals. Aerobic. Over 150 serotypes.	4 to 19 days, usually 10 days. Fever, headache, chills, malaise, vomiting, muscular pain. Duration 2 to 4 weeks.	Urine and infected tissues of wild and domestic animals. Waterborne.	Possibly milk, meat, ham, kidneys (?)	Animal tissue, blood, urine, water. Isolation, animal inoculation, microscopy, serology.	Cook foods thoroughly. Protect foods from contamination by animal urine.
Pasteurellosis (8, 236)	<i>Pasteurella multocida</i>	Gram-negative, encapsulated, nonmotile, bipolar, coccobacillus. Pleomorphic. Aerobic, facultatively anaerobic.	Infection of many sites and symptoms depend upon infected site. Septicemic form.	Infected animals and their secretions.	Poultry, vegetables soiled with animal feces (?)	Sputum, pus, cerebrospinal fluid, blood, urine, infected animal tissue. Isolation, identification.	Cook foods thoroughly. Protect foods from contamination by animal feces.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
<b>VIRAL AND RICKETTSIAL DISEASES (3,4,8,11,12,14,26-30)</b>							
Epidemiological Evidence of Foodborne Transmission							
Hepatitis A (Non-B)	Hepatitis virus A	Not propagated in tissue culture. Isometric, 27nm in diameter. Probably RNA	14 to 50 days, usually 25 to 30 days. Systemic infection characterized by constitutional and gastrointestinal manifestations and by injury to liver. Fever, malaise, lassitude, anorexia, nausea, abdominal discomfort, bile in urine, jaundice. Severity usually increases with age. Duration of a few weeks to several months.	Feces, urine, blood, of infected human cases and persons incubating 2-3 weeks before jaundice) disease or within 1 week after jaundice. Non-human primates also reservoirs. Main route of transmission: person-to-person; also waterborne. More common in fall and winter, in rural areas, and in children, but in foodborne outbreaks high rates occur in adults. Secondary cases occur in household contacts.	Oysters, clams, milk, orange juice, potato salad, cold cuts, frozen straw-berries, glazed doughnuts, whipped cream cakes, sandwiches, mixed vegetable salads.	Urine, acute or convalescent serum, feces. Clinical and epidemiological evidence and exclusion of other diseases. Liver function test, serum glutamic oxalacetic transaminase. Serology of acute or convalescent serum. ELISA test.	Prevent pollution of shellfish growing areas. Dispose of sewage in sanitary manner. Treat water by coagulation-settling-filtration-chlorination. Practice personal hygiene. Cook foods thoroughly. Isolate cases for 7 to 10 days after jaundice. Clean and sterilize needles, syringes, and other instruments used for parenteral injections. Give gamma globulin to contacts.
Norwalk Virus	Norwalk-like agents	Unclassified (perhaps parvovirus). Bacteriophage-free filtrates cause illness when serially transmitted to volunteers. Acid (pH 2.7) resistant; survives 140F for 30 min. 25 x 32 nm size.	16 to 48 hours. Nausea, vomiting, abdominal pain, diarrhea, low grade fever, chills, malaise, anorexia, headache, myalgia. Duration 24 to 48 hours.	Feces. Illness primarily associated with older children and adults.	Oysters, cockles. Could be any food contaminated with feces.	Feces, suspect foods. Serology (RIA), virus isolation (tissue culture).	Practice personal hygiene. Dispose of sewage in sanitary manner. Practice personal hygiene. Prepare food in sanitary manner. Cook food thoroughly.
Gastroenteritis (Epidemic Diarrhea, Poisoning, Winter Vomiting Disease) (30,299)	Cockle Hawaii, Montgomery County agents).						
Polymyelitis (100,140)	Poliovirus	Small RNA, cubical, naked Picornaviridae virus. Replicates in cytoplasm. Among most stable viruses known. Resistant to low pH. 3 serotypes - I, II, III.	3 to 21 days, commonly 7 to 12 days. Fever, headache, gastrointestinal disturbances, constipation, malaise, stiffness of neck and back with or without flaccid paralysis.	Feces and pharyngeal secretions of infected persons. Main route of transmission: Person-to-person. Countries with low standards of hygiene children infected early. With improved hygiene infections occur later in life.	Milk, cream-filled pastry, lemonade (?).	Feces, pharyngeal swabs, spinal fluid. Tissue culture (monkey or human kidney). Monkey inoculations. Serology (cross neutralization or complement fixation).	Immunize against all three types of poliovirus. Cook foods thoroughly. Practice personal hygiene. Dispose of sewage in sanitary manner.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Bollivan Hemorrhagic Fever (115,181, 251)	Machupo virus	Arenaviridae, Tacaribe group. Probably RNA core. Replicates in cytoplasm.	10 to 14 days. Malaise; headache; eye, leg, and back pain; fever; sweats; prostration. Exanthems on throat, flanks, and soft palate. Duration 1 to 2 weeks. Relapses occur. 30% case fatality rate.	Urine of Infected rodent ( <i>Calomys callosus</i> ).	Corn and other cereals. Possibly any food contaminated with rodent urine.	Blood, throat swabs, urine. Serology, complement fixation.	Control rodents. Protect food from contamination. Cook foods thoroughly.
Russian Spring-Summer Encephalitis (Diphasic Milk Fever) (237)	Russian tick-borne virus complex. Russian Spring-Summer Louping-ill group viruses.	Group B Arbovirus. Probably RNA core. Replicates in cytoplasm.	7 to 14 days. Sudden onset, headache, fever, nausea, vomiting, hyperesthesia, photophobia, weakness, delirium, coma, meningoencephalitis, flaccid paralysis - particularly of shoulder girdle with residue. Disphasic (fever and meningoencephalitis) 4 to 10 days after apparent recovery. Three weeks' duration.	Infected ticks. Animals infected by ticks. Also transmitted to man by tick bites. Reported in Russia.	Raw milk from goats or sheep.	Blood, cerebrospinal fluid, brain tissue of fatal cases. Animal inoculations, chick embryo culture, serology.	Pasteurize milk. Control ticks. Immunize (USSR).
Kuru (148,149)	Kuru virus.	Unclassified. Causes marked increase of astrocytes and degeneration of neurons. Survives 185P for 30 minutes.	Several months or years. Unsteadiness of stance gait, tremor, ataxia laughter, abnormalities of extraocular movement and mental changes. Death in 3 to 6 months.	Predominantly affects women and children of Fore tribe in New Guinea. Transmitted by ritual cannibalism. Genetic factor may predispose.	Uncooked human brain tissue.	Brain tissue of fatal cases.	Suppress cannibalism.
Creutzfeldt-Jakob Disease (26,108, 149)	Agent similar to Kuru agent	Unclassified	12 months to years. Dementia, severe visual disturbances, myoclonic jerking. No remission or recovery.	Infected animal brains.	Inadequately cooked sheep, swine brains (?).	Brain tissue of fatal cases.	

Viral Diseases Which Could Possibly Be Transmitted By Foods, But Proof Is Lacking

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Lymphocytic Chorlo- meningitis (114)	Virus of lymphocytic chorio- meningitis	Arenaviridae RNA virus that is probably enveloped.	8 to 21 days, 15 to 21 days to meningeal symptoms. Fever, chills, sore throat, cough, head- ache, vomiting, neck stiffness, photophobia, acute aseptic menin- gitis. Recovery in a few weeks.	Nasal secretions, urine, feces, and semen of mice ( <i>Mus musculus</i> ), and hamsters ( <i>Meso- cricetus auratus</i> ) contaminate man's environment. Dust, skin abrasions in- volved in trans- mission. Virus may persist in mouse through life. Guinea pigs, monkeys, dogs, swin also infected.	Unknown, could possibly be any food contam- inated by mice.	Blood, urine, nasopharynx or cerebrospinal fluid, CNS tissue. Isolation, identification, serology. Ani- mal (mouse or guinea pig) inoculations.	Control rodents. Clean home and work environments (sanitation).
Lassa Fever (114, 115, 210)	Lassa virus	Arenaviridae RNA virus	6 to 14 days. Malaise, asthenia, lassitude, headache, unremitting fever, sore throat, muscular aches, abdominal cramps, loss of appetite, nausea, vomiting, diarrhea, pharyn- gitis, blurred vision, flushing, subcutaneous hemorrhages, puffed face, swollen neck, oliguria, dysuria. Duration 7 to 21 days. Death 30% to 66%.	Rodent ( <i>Mastomys natalensis</i> ) trans- mission (?). Contact with rodent or excreta, eating uncooked rodent flesh, food con- taminated by rodent excreta, airborne.	Rodent flesh (?), grain or any food contam- inated by rodents (?).	Complement fixation, tissue culture, electron microscopy.	Control rodents. Strict isolation of patients.
Rotavirus Gastro- enteritis (Infantile Gastro- enteritis) (30, 206)	Rotaviruses (Duovirus; Orbivirus)	Spherical RNA Reoviridae virus, 65 to 75 nm in diameter. Wheel- like appearance. Replicates in cytoplasm. Two serotypes of human viruses.	1 to 3 days. Vomiting, followed by diarrhea (watery green or yellow stool), malaise, fever, abdominal pain, dehydration. Duration 2 to 16 days in in- fants, 24 hours or less in adults. Death from dehydration or aspiration of vomitus.	Calves, piglets, monkeys, sheep, mice, and other animals carry identical or similar virus. Person-to-person spread is common. Common cause of diarrhea in infants and young children.	Unknown. Could be any contam- inated food.	Feces, biopsy of duodenal tissue. Serology (RIA, ELISA) Virus isolation (tissue culture).	Practice personal hygiene. Dispose of sewage in sanitary manner. Prepare food in sanitary manner. Cook foods thoroughly.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
ECHO Virus Infections (26,286)	ECHO (Enteric cytopathogenic human orphan) viruses, types 1-9, 11-27, 29-34.	Small RNA, cubical, naked viruses. Replicates in cytoplasm. Resistant to low pH, relatively stable. 33 serotypes. Type 18 frequently associated with diarrhea. Also, types 11,19,20.	Few days. Diarrhea (greenish, watery). Fever and respiratory symptoms may accompany diarrhea. Also causes febrile illness, aseptic meningitis, and paralysis. Duration of diarrhea, 1 to 5 days.	Transient inhabitant of human alimentary tract and found in feces.	Unknown, could be any contaminated food.	Throat swabs, stools, cerebrospinal fluid, feces. Tissue culture (monkey kidney), serology (hemagglutination, complement fixation).	Practice personal hygiene. Dispose of sewage in sanitary manner. Cool foods thoroughly.
Coxsackie Infections Herpangina (Summer Grippe)(26, 126)	Coxsackie Group A viruses (including types 2,4,5, 6,8,10,22,24)	Relatively stable, small RNA, cubical, naked viruses. Replicates in cytoplasm. Resistant to low pH. 24 serotypes and 3 subtypes.	3 to 5 days (1 to 14). Fever, lassitude, anorexia, dysphagia, sore throat, stomatitis (papules on soft palate) vomiting, abdominal pain, convulsions. Viruses also cause febrile illness, aseptic meningitis, paralysis, common cold, rash, hand-foot-and-mouth disease (stomatitis with exanthems).	Transient inhabitant of human alimentary tract and readily isolated from feces. Also found in nose and throat discharges. Most illnesses are in children in summer months.	Unknown, could be any contaminated food.	Feces, blood, pharyngeal swabs, cerebrospinal fluid. Mouse inoculations, serology.	Practice personal hygiene. Dispose of sewage in sanitary manner. Cook foods thoroughly.
Pleuro- dynia (Epi- demic Myalgia (26,126)	Coxsackie Group B viruses, types 1,2, 3,4,5,6.	Relatively stable, small RNA, cubical, naked viruses. Replicates in cytoplasm. Resistant to low pH. 6 serotypes.	3 to 5 days (1 to 14). Abrupt onset, intermittent fever, myalgia, chest and abdominal pain, headache, malaise. Viruses also cause febrile illness, aseptic meningitis, systemic infection (myocarditis).	Transient inhabitants of human alimentary tract and readily isolated from feces. Also found in nose and throat discharges. Most illnesses are in children in summer months. Evidence suggests that person-to-person spread is most common mode of transmission.	Unknown, could be any contaminated food.	Feces, throat swabs, cerebrospinal fluid, blood. Tissue culture (monkey kidney) or human amnion cells, mouse inoculation serology.	Practice personal hygiene. Dispose of sewage in sanitary manner. Cook foods thoroughly.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Adenovirus Infections (26,153, 268)	Adenoviruses	DNA, cubical, naked viruses. 31 serotypes and 1 subtype (28 isolated from man). Relatively stable.	Few days. Diarrhea, fever, vomiting, abdominal pain. Viruses also cause respiratory or eye infections, septic meningitis.	Nose, eye, and throat discharges, feces, urine. Respiratory and person-to-person spread more common.	Unknown, could be any contaminated food.	Feces, pharyngeal or eye infections. Electron microscopy. Tissue culture, serology (hemagglutination).	Practice personal hygiene. Dispose of sewage in sanitary manner. Cook foods thoroughly.
Reovirus Infections (26,238)	Reoviruses (Respiratory enteric orphan viruses). Reovirus (formerly classified as ECHO 10).	Double-strand RNA, cubicle, naked virus. Replicates in cytoplasm. High heat resistance. Three serotypes of the Reovirus group.	2 days or less. Virus isolated from individuals with a wide range of symptoms - respiratory tract diseases, gastrointestinal diseases, and central nervous system disease.	Feces, nose, throat. Wide host range of man and animals. Respiratory and person-to-person spread more common.	Unknown, could be any contaminated food.	Feces, nasal or throat swabs. Tissue culture (monkey kidney), serology (hemagglutination).	Practice personal hygiene. Dispose of sewage in sanitary manner. Cook foods thoroughly.
Hepatitis B (Serum Hepatitis (HBsAg) (143, 186, 279, 296, 297)	Hepatitis virus B (HBsAg)	Unclassified, double-strand DNA virus, 24 nm in diameter. Survives 4 hours at 140F. Rapidly destroyed by hypochlorite.	88 to 108 days, average 98 days (oral exposure); shorter (65 days average) after parental exposure.	Serum, saliva, nasopharyngeal secretions, semen. Long-term carrier state. High rate of infection in homosexuals, infants from mothers at birth. Period of infectivity lasts until HBsAg disappears.	Unknown, possibly any contaminated food.	Serum, urine. Liver function test, serology (HBsAg) of acute serum.	Practice personal hygiene. Dispose of sewage in sanitary manner. Cook foods thoroughly.
Calicivirus Diarrhea (30)	Calicivirus (WESC)	RNA virus, 35-39 nm in diameter.	Diarrhea.	Unknown, virus related to virus that causes vesicular exanthema of swine.	Unknown.	Feces, suspect foods. Serology, tissue culture.	Cook foods thoroughly, prepare foods in sanitary manner.
Coronavirus Diarrhea (30)	Human coronavirus, Human enteric coronavirus.	Enveloped RNA virus, 75-160 nm in diameter.	Diarrhea.	Related agents cause diarrhea in calves, dogs, turkeys.	Unknown.	Feces, suspect foods. Serology, tissue culture.	Cook foods thoroughly, prepare foods in sanitary manner.
Astrovirus Diarrhea (30)	Astrovirus	Unclassified, 28 nm in diameter, star-shaped.	Diarrhea	Agent found in stools of ill and well infants.	Unknown.	Feces. Serology.	Cook foods thoroughly, prepare foods in sanitary manner.



DISEASE,	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
Trichinellosis, (Trichineliasis) (32,37, 157,201)	<i>Trichinella spiralis</i>	Delicate, thread-like roundworm (nematode). Larvae excyst in duodenum. Females invade mucosa of small intestine, larviposit. Larvae travel via blood and lymph, encyst in muscle.	4 to 28 days, usually 9 days. First stage (intestinal invasion): Nausea, vomiting, diarrhea, abdominal pain. Second stage (muscle penetration): Irregular and persistent fever, edema of eyes, profuse sweating, muscular pain, thirst, chills, skin lesions, weakness, prostration, labored breathing. Third stage (tissue repair): Generalized toxemia, myocarditis. High eosinophile blood count.	Meat of infected animals. Reservoirs: Swine, boar, rats, fox, wolf, bear, marine mammals (more than 40 species of wild animals). Pigs are primary source of trichinellosis for humans. Incidence declining in U.S.	Pork, bear meat, walrus flesh, dog meat. Frequently home-made raw pork sausage.	Muscle biopsy (gastrocnemius, deltoid), blood, skin test. Diaphragm muscle of swine and bear. Microscopy (cysts), serology. (ELISA)	Cook pork thoroughly (until it turns white) to 137F or above. Freeze and store pork < 6" thick at 5F for 20 days, -10F for 10 days, -20F for 6 days; > 6" thick at 5F for 30 days, -10F for 20 days, -20F for 12 days. Cook garbage for feeding pigs at 212F for 30 minutes. Cure meat adequately. Eliminate rodents from hog lots.
Taeniasis (Beef or Pork Tapeworm Infections) (32,33, 37,228,280)	<i>Taenia saginata</i> (Beef tapeworm)	Flatworm (cestode). Ingested larvae ( <i>Cysticercus bovis</i> ) develop into adult worms in intestines. Adults attach to mucosa of small intestine by their scoleces. Average length 5 meters. Eggs may remain viable for 6 months.	3 to 6 months. Variable, frequently vague or absent. Nervousness, insomnia, hunger pains, anorexia, weight loss, abdominal pain. Digestive disturbances such as nausea, vomiting, colic, and diarrhea sometimes occur.	Human feces containing eggs or proglottids. Immediate source: Flesh of infected cattle. Occurs in East Africa, South and Central America, Asia, Eastern Europe, Southwest U.S.	Beef.	Feces, beef. Microscopy (eggs, proglottids).	Dispose of sewage in sanitary manner. Inspect meat. Cook beef thoroughly (>135F), freeze (15F, 10 days). Avoid pasturing cattle where human feces or sewage accumulate. Diagnose and treat cases.
	<i>Taenia solium</i> (Pork tapeworm)	Flatworm (cestode). Adult worm attaches to mucosa of small intestine. Average length < 3 meters.	3 to 6 months. Variable, frequently vague or absent. Nervousness, insomnia, hunger pains, anorexia, weight loss, abdominal pain. Digestive disturbances such as nausea, vomiting, colic, and diarrhea sometimes occur.	Human feces containing eggs. Immediate source: flesh of infected pigs. Worldwide. Rare in U.S.	Pork.	Feces, pork. Microscopy (eggs, proglottids).	Dispose of sewage in sanitary manner. Inspect meat. Cook pork thoroughly, freeze. Keep swine away from areas where human feces or sewage accumulate. Treat cases.

PARASITIC DISEASES (3, 4, 8, 12, 14, 31-37)

Always or Usually Transmitted by Foods

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Cysticercosis (22b)	<i>Taenia solium</i> larvae, <i>Cysticercus cellulosae</i>	Larval stage. Cysticerci develop in subcutaneous tissues, muscles, and may localize in brain, eyes, heart, central nervous system.	3 months. Pain at site of cysticercal development.	Human feces. Autoinfection.	Probably none, but may be any food or water contaminated by human feces containing eggs of the parasite. Vegetables contaminated with night soil are a possibility. Pork may introduce the tapeworm initially.	Serum, biopsy of infected tissue. Microscopy (cysticercii), x-ray, serology.	Practice personal hygiene. Treat cases. Immunize animals.
Diphyllobothriasis (Fish Tapeworm Infection) (32,33, 39,280)	<i>Diphyllobothrium latum</i> (Broad or fish tapeworm) <i>D. pacificum</i>	Flatworm (cestode). Adult attaches to mucosa of small intestine. Length is 10 meters or more.	5 to 6 weeks. Symptoms often trivial or absent. Nausea, vomiting, weakness, dizziness, diarrhea or constipation, anemia may occur.	Infestive eggs from human feces, dogs, and other fish-eating mammals contaminate water sources. Intermediate host: Copepods. Immediate source: Flesh of infected fish. Occurs in Great Lakes region and Florida.	Raw or partially cooked or inadequately pickled freshwater fish (pike, pickerel). Raw marine fish ( <i>D. pacificum</i> )	Feces, fish. Microscopy (eggs).	Cook freshwater fish thoroughly. Dispose of sewage in sanitary manner. Prevent stream pollution. Freeze fish (14F for 24 hours). Treat cases.
Sparganosis (31,32, 33,280)	Sparganum of <i>Diphyllobothrium latum</i> and <i>Spirometra mansonioides</i> and other spp. Other sparganum tapeworms that are incapable of maturing to adults in human body.	Tapeworm (cestode), ribbon-like larvae.	Month or longer. Tender, puffy areas around site of parasite, irritation and migratory swelling.	Cat and dog feces. Intermediate host: Water fleas (cyclops). Immediate source: Water, fish, frogs, snakes. Transmission also occurs by drinking water containing water fleas and by using animal meat as poultice. Reported in Orient and Southwestern U.S.	Tadpoles, snakes, frogs.	Infected human tissue (biopsy), fish. Microscopy (cross section of larva).	Cook foods thoroughly. Abstain from eating raw flesh of infected animals. Avoid using raw vertebrates as poultices. Protect or boil water.
Angiostrongyliasis (Eosinophilic meningoenzephalitis) (82)	<i>Angiostrongylus cantonensis</i>	Roundworm (nematode). Adult worm lives in pulmonary artery of rats and deposits eggs in blood. Larvae hatch from eggs and travel up trachea where they are swallowed and pass in feces.	14 to 16 days. Gastrointestinal upset, encephalitis (headache, stiffness of neck and back, paresis), low grade fever.	Rat feces. Larvae penetrate terrestrial mollusks (snails and slugs) or marine mollusks. Reported in Asia and Pacific Islands. Eating habits and customs of people play important role in transmission.	Raw crab, prawns, garden slugs, land planarian, shrimp, snails. Raw vegetables (?).	Mollusks, rats, serum, autopsy tissue. Microscopy (worms), serology.	Cook foods thoroughly, freeze (5F). Avoid eating raw, freshwater prawns, raw land mollusks and raw crab.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Abdominal Angiostrongyliasis (33)	<i>Angiostrongylus costaricensis</i>	Roundworm (nematode). Worms congregate in appendiceal region, may mature and lay fertile eggs.	Abdominal pain, anorexia, vomiting, fever. Distended abdomen, marked leukocytosis. May persist 2 months.	Mesenteric arteries of rats. Slug intermediate host.	Salad, vegetables contaminated by slugs.	Slugs, rats, serum, autopsy tissue.  Microscopy (worms). Serology	Cook foods thoroughly, freeze (50F). Avoid eating slugs.
Anisakiasis (Herring worm disease) (32, 39, 257, 276)	<i>Anisakis</i> spp. <i>Contracaecum</i> spp.	Roundworm (nematode). Highly resistant to brine, easily killed by 140F and freezing.	4 to 6 hours. Gastric: Sudden stomach pain, nausea, vomiting, eosinophilia in 7 days. Intestinal: Severe lower abdominal pain, nausea, vomiting, fever, diarrhea, occult blood in stools, leukocytosis, ascites.	Adult worm lives in intestine of fish-eating sea mammals. Larvae found in herring. Reported in Holland, Japan, England, U.S.	Marine fish or squid. Herring (raw, partially cooked, pickled, smoked).	Stools, stomach or intestinal tissue, herring. Microscopy (worms).	Cook herring thoroughly. Freeze at -4F within 12 hours and hold for 24 hours. Preserve with high concentrations of NaCl and hold for 10 days. Proper cleaning of fish to be eaten raw.
Fasciolopsiasis (31, 32, 33)	<i>Fasciolopsis buski</i>	Large intestinal fluke (trematode). Adult attaches to intestinal mucosa.	3 months. Diarrhea alternating with constipation, abdominal pain, nausea, vomiting, anorexia, intestinal obstruction may occur, edema of face and abdomen, weakness.	Human, dog, or hog feces containing fluke eggs contaminate fresh water. Intermediate host: snail. Cercariae encyst on water vegetables. Skins of water vegetables are bitten into and peeled off with teeth. Occurs in Orient.	Water chestnuts, water bamboo, water hyacinths, water caltrop, lotus plant root.	Feces, suspect foods. Microscopy (eggs).	Avoid hulling or peeling water plants with teeth or lips - use a knife or drop in boiling water. Dry plants. Cook water-grown vegetables thoroughly. Dispose of sewage in sanitary manner. Control snails. Treat patients. Eradicate water caltrop from endemic areas.
Echinostomiasis (31, 33)	<i>Echinostoma revolutum</i> , <i>E. melis</i> , <i>E. cinetorchis</i> , <i>E. macrorchis</i> , <i>E. recurvatum</i> , <i>E. ilocanum</i> , and other spp.	Intestinal fluke (trematode). Adult attaches to small intestinal wall.	Several months. Inflammatory reaction at site of attachment to intestinal wall, intestinal colic, diarrhea.	Infective feces of man, dogs, fowl, rats contaminate fresh water. Immediate source: Snails. Occurs in Orient.	Raw snails and clams. Also limpets, freshwater fish, or tadpoles.	Feces, suspect foods. Microscopy (eggs).	Cook snails and thoroughly. Dispose of sewage in sanitary manner.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Himasthia Infection (31)	<i>Himasthia muhliensis</i>	Intestinal fluke (trematode)	Gastroenteritis.		Raw clams.	Feces, clams. Microscopy.	Harvest shellfish from unpolluted waters. Cook shellfish.
Clonorchiasis (31,32,33, 39,187)	<i>Clonorchis sinensis</i> (Chinese liver fluke)	Slender hepatic fluke (trematode). Habitat in man is distal biliary passages and pancreatic duct.	Undetermined. Flukes mature in 16 to 25 days. Probably several weeks. First stage: fever, epigastric pain. Second stage: loss of appetite, diarrhea, low grade fever, tenderness over liver, bile duct obstruction. Third stage: cirrhosis, progressive ascites and edema, jaundice.	Infective feces of man, cats, dogs, hogs, or other animals which are hosts of adult flukes contaminate fresh water. Intermediate host: snails. Encyst in muscle of freshwater fish. Occurs in Orient and Eastern Europe.	Raw or partially cooked fresh, dried, salted, or pickled fish (carp and 80 other species).	Feces, bile, fish. Microscopy (eggs), serology.	Cook freshwater fish thoroughly. Dispose of sewage in sanitary manner. Keep sewage out of streams. Control snails.
Heterophyid Infections (31,32,33)	<i>Heterophyes heterophyes</i> , <i>Stellaricolasma taeniatum</i> and other spp., <i>Haploporchis pumilio</i> , and other spp. Other trematodes that cause heterophyid infections are <i>Stamosoma</i> spp., <i>Toxotrema lingua</i> , <i>Apophaltes venustus</i> .	Small intestinal fluke (trematode). Attaches to mucosa of upper levels of small intestine. Similar to <i>Clonorchis</i> .	Several weeks. Abdominal pain; diarrhea containing mucus; heart, brain, or spinal cord involvement may follow.	Infective feces of fish-eating birds and mammals contaminate fresh water. Intermediate host: snails. Encyst in fish muscle. Occurs in Orient, Egypt, and Southeast Europe.	Raw, partially cooked, salted or dried freshwater or brackish-water fish (mullet).	Feces, fish. Microscopy (eggs).	Cook fish thoroughly. Prevent stream pollution. Control snails. Dispose of sewage in sanitary manner.
Opisthorchiasis (31,32,33, 39)	<i>Opisthorchis felinus</i> , <i>O. viverrini</i>	Hepatic fluke (trematode). Resembles <i>C. sinensis</i> .	Several weeks. Cirrhosis of liver resembling Clonorchiasis.	Infective feces from humans and piscivorous mammals, containing eggs. Snails ingest eggs. Cercariae penetrate freshwater cyprinoid fish. Occurs in Central and Eastern Europe and the Orient.	Freshwater fish.	Feces, fish. Microscopy (eggs).	Cook freshwater fish thoroughly. Dispose of sewage in sanitary manner. Keep sewage out of streams. Control snails.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
Metagonimiasis (31,32,33)	<i>Metagonimus yokogawai</i>	Small intestinal fluke (trematode). Attaches to mucosa of upper levels of small intestines. Similar to <i>Clonorchis</i> .	Several weeks. Abdominal pain; diarrhea containing mucus; heart, brain, or spinal cord involvement may follow.	Infective feces of fish-eating birds and mammals contaminate fresh water. Intermediate host: snails. Encyst in fish muscle. Occurs in Orient, Egypt, and Southeast Europe.	Raw, partially cooked, salted or dried freshwater or brackish-water fish (trout).	Feces, fish. Microscopy (eggs).	Cook fish thoroughly. Prevent stream pollution. Control snails. Dispose of sewage in sanitary manner.
Fascioliasis (Sheep. Liver Infection) (31,32,33, 101,128)	<i>Fasciola hepatica</i> and <i>F. gigantica</i>	Large hepatic fluke (trematode). Fluke burrows through intestinal wall to liver.	Several months. Lesions in bile passages, coughing, vomiting, jaundice, abdominal rigidity, diarrhea, irregular fever, profuse sweating, eosinophilia, systemic intoxication.	Infective feces from humans, sheep, cattle, or other herbivorous and omniferous animals, containing eggs, contaminate fresh water. Intermediate host: snails. Cercariae encyst on aquatic vegetables. Occurs in South and Central America, Southern Europe, Middle East, Hawaii.	Aquatic vegetation, watercress.	Feces, watercress.	Eradicate infection in sheep and other herbivorous animals. Omit watercress in salads in endemic areas. Dispose of sewage in sanitary manner. Drain pastures. Prevent stream pollution. Control snails.
Paragonimiasis (31,32,33, 39,292)	<i>Paragonimus westermani</i> (Oriental lung fluke) <i>P. skrjabini</i> , <i>P. heterotremus</i> , <i>P. tuanshanensis</i> , <i>P. africanus</i> , <i>P. chirai</i> , <i>P. iloktsuenensis</i> .	Plump, oval fluke (trematode). Penetrates intestinal wall and reaches lungs.	Long and variable, many months. Cough, hemoptysis. Roentgenographic findings closely simulate those of pulmonary tuberculosis. Migrations and ectopic development in intestine, lymph glands, genitourinary tract, subcutaneous tissue, and brain.	Sputum and feces from man and other carnivores containing eggs contaminate fresh water. Intermediate host: snails. Cercariae encyst in freshwater crab or crayfish. Occurs mainly in Orient and Pacific Islands.	Raw or partially cooked crab or crayfish.	Feces, sputum, crab, crayfish. Microscopy (eggs), immunodiagnostic tests (intradermal, complement fixation). X-ray.	Cook crustacea thoroughly. Heat at 131F for 5 minutes. Dispose of sewage in sanitary manner. Prevent stream pollution. Control snails. Mass treatment in endemic areas.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ signs and symptoms	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Dicrocoeliasis (33,91)	<i>Dicrocoelium dendriticum</i>	Small hepatic fluke (trematode).	7 weeks. Constipation, diarrhea, abdominal pain, enlarged and tender liver.	Infective animal (cattle, sheep) feces, containing eggs. Snails ingest eggs. Larvae leave snails in slime balls that infect ants. Ants are ingested by animals or accidentally by man; rarely by dietary preference. Occurs in tropics (rare).	Ants or foods (raw, unwashed vegetables) contaminated by ants (during picnics, camping, etc.).	Feces, sheep liver. Microscopy (eggs).	Wash vegetables. Cook foods thoroughly. Dispose of sewage in sanitary manner. Keep sewage out of streams. Control snails and ants. Protect foods from ants.
Hymenolepiasis Diminuta (31)	<i>Hymenolepis diminuta</i> (Rat tape-worm)	Flatworm (cestode). Length is from 20 to 60 cm.	Diarrhea, abdominal pain, and indefinite gastrointestinal complaints.	Feces of rats, mice, man. Intermediate hosts: insects (fleas, cockroaches, beetles, mealworms) ingest eggs.	Grains and cereals.	Feces, beetles. Microscopy (eggs).	Avoid eating insect-contaminated grains and cereals. Inspect grains and cereals. Rodent stoppage; control rodents in grain storage areas. Insect control.
Hymenolepiasis Nama (31)	<i>Hymenolepis nama</i>	Flatworm (cestode). Length is from 25-40 mm.	Abdominal pain, diarrhea, anorexia, dizziness, headache, pruritic rash.	Feces of mice and man. Fleas and beetles may serve as intermediate hosts.	Grains (?)	Feces. Microscopy (eggs).	Sanitary disposal of sewage, rodent control. Protection of food from rodent contamination.
Gastrodisciasis (31)	<i>Gastrodiscoides hominis</i>	Trematode.	Mucous, diarrhea.	Pigs and deer are reservoirs. Snails may be intermediate hosts.	Vegetables (?)	Feces. Microscopy (parasite or eggs).	Sanitary disposal of sewage.
Diocetophyma (248)	<i>Diocetophyma renale</i> (Giant kidney worm)	Roundworm (nematode) Length 14 to 100 mm.	Renal dysfunction or ureteral obstruction.	Urine of infected large fish-eating mammals.	Fish.	Urine. Microscopy (eggs or worm).	Sanitary disposal of sewage, thorough cooking of fish. Drink safe water.
Toxicariasis (Visceral larvae migrants) (33)	<i>Toxocara caris</i> , <i>T. cati</i>	Prolonged migration of larvae in human tissue.	Fever, malaise, pallor, anorexia, failure to gain weight, muscle and joint pain, nausea, vomiting, convulsions, pruritic rash.	Infective feces of dog or cat reach soil.	Soil contaminated foods.	Blood. Count eosinophils.	Avoid eating dirt, wash vegetables, deworm dogs.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
Gnathostomiasis (Creeping Eruption, Larva Migrans) (31, 32)	<i>Gnathostoma spinigerum</i> <i>G. doloresi</i> , <i>G. nipponicum</i>	Roundworm (nematode). Extra-intestinal sites in humans.	Epigastric pain, nausea, vomiting, edema, fever, granomatous lesions, stationary abscesses. Infection may persist for years.	Adult parasites in gastric tumors of dogs and cats. Eggs pass in feces to water. Intermediate hosts: Water fleas (cyclops). Immediate source: Fish muscle. Third stage larvae migrate to muscle of species eating infected fish, frogs, birds, snakes and remain infective.	Raw, fermented, or partially cooked fresh-water fish; snakes, birds, mammals.	Emerging worms from skin, abscesses, or natural orifices, biopsy. Microscopy (larvae), skin test.	Cook foods thoroughly.
Intestinal Myiasis (298)	Diptera. <i>Piophilidae casei</i> (cheese skipper), <i>Musca domestica</i> (common house fly), <i>Stomoxys calcitrans</i> (stable fly) <sup>3</sup>	Larvae of flies that oviposit or larviposit in manure, decaying vegetation, or meat. Lesions, damage to mucous membranes, or hemorrhagic infiltrations occur in the intestines due to secretions or injuries inflicted by mouth parts or spines.	Vomiting, diarrhea, abdominal pain, convulsions.	Flies. <sup>3</sup> Larvae of most flies do not continue development in alimentary tract; thus, only cause a pseudo-miasis (do not feed or continue development, just pass through).	Meat, fruit, watercress, cheese, or other contaminated food or water that has been exposed to flies.	Feces. Microscopy (note that contamination of stools with eggs that hatch into larvae may occur after defecation).	Practice good sanitation. Protect foods from insect contamination. Control flies.

<sup>3</sup>Other Diptera reported as causing myiasis include: *Anisopus fenestralis*, *Psychoda sexpunctata*, *Megaselia scalaris*, *Megaselia spiracularis*, *Eristalis tenax* (Drone Fly), *Eristalis arbustorum*, *Teichomyza fusca*, *Musca crassirostris*, *Muscina stabulans* (False stable fly), *Fannia canicularis* (Lesser house fly), *Fannia scalaris* (European latrine fly), *Fannia manicata*, *Calliphora vicina* (European blue bottle fly), *Calliphora vomitoria* (Red-bearded blue bottle fly), *Calliphora croceipalpis*, *Chrysomya chloropyga* (Green-tailed blow fly), *Sarcophaga haemorrhoidalis* (Red-tailed flesh fly), *Sarcophaga hirtipes*, *Sarcophaga striata*.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Amebiasis (Amebic Dysentery) (16, 31, 81, 137, 225, 226)	<i>Entamoeba histolytica</i>	Amebic protozoan has four stages (trophozoite, pre-cyst, cyst, metacyst). Vegetative stage (trophozoite) is very fragile; cyst stage does not survive drying. After ingestion, intestinal juices render cyst wall permeable and trophozoite emerges. Vegetative stage multiplies in mucosa or lumen of colon. Encysts in the lumen of intestine. Invades mucosa of colon.	Usually Transmitted by Other Means 5 days to several months, usually 3 to 4 weeks. Variable symptoms, including abdominal discomfort, diarrhea, constipation; blood and mucus may be observed in stools; distention, headache, drowsiness, ulcers. May spread to blood stream causing organ infections and abscess of liver, lungs, or brain. Most infections are asymptomatic.	Human feces containing cysts. Main mode of transmission: Personal contact. More common in tropics, mental institutions, and underdeveloped areas.	Raw vegetables and fruits.	Feces, lesion exudates, material aspirated from ulcers. Microscopy (vegetative and cyst stages), serology	Practice personal hygiene (food handlers). Cook foods thoroughly. Dispose of sewage in sanitary manner. Protect and treat water. Control flies. Avoid using human excreta for fertilizer (night soil).
Ascariasis (31, 32, 33, 272)	<i>Ascaris lumbricoides</i>	Giant roundworm (nematode). Adult lives free in small intestine. Eggs are very resistant to environmental changes, and in warm, humid areas they remain infective for a year or longer.	2 months. Variable, often vague or absent. Digestive disturbances, abdominal pain, exaggerated reflexes, restlessness, disturbed sleep. Worms in stools or vomitus. Lung involvement may occur. Large numbers of worms may cause intestinal blockage.	Infective eggs from human feces. Eggs require several days in soil to allow infective larvae to develop. Main mode of transmission: Personal contact and eating dirt. More frequent in moist, tropical countries where prevalence may exceed 50% of a population.	Raw vegetables and fruits.	Feces. Microscopy (eggs), serologic tests.	Dispose of sewage in sanitary manner. Practice personal hygiene. Cook foods thoroughly. Compost feces used as fertilizer. Anthelmintic medication - mass treatment every 6 months to 1 year in endemic areas.
Trichuriasis (31, 33, 288)	<i>Trichuris trichiura</i> (Whipworm)	Roundworm (nematode). Eggs are very resistant to environmental changes. Attaches to mucosa of cecum, appendix, colon, and rectum.	Long and variable, several months. Asymptomatic to abdominal discomfort, emaciation, anemia, constipation, loss of appetite, vomiting.	Infective eggs from human feces. Source is soil contamination since egg must develop for 10 to 21 days in soil. Particularly common in warm, moist regions. Greatest prevalence in school-age children.	Any soil-contaminated food(?)	Feces. Microscopy (eggs).	Dispose of sewage in sanitary manner. Practice personal hygiene. Cook foods thoroughly. Prevent children from eating dirt.



DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY	CONTROL MEASURES
Capillariasis (31,33, 39)	<i>Capillaria hepatica</i> and <i>C. philippinensis</i> (Capillary Liver Worm)	Roundworm (nematode) related to the whipworm. Eggs hatch in duodenum; larvae enter intestinal wall and migrate to liver. Causes malabsorption due to atrophic changes in intestinal mucosa.	Month or longer. Diarrhea. Acute or subacute hepatitis with eosinophilia and visceral larva migrans.	Liver (containing embryonated eggs) of peccary, monkey, hare, and rodents. Also transmitted by contaminated soil, freshwater fish. Rarely reported.	Liver, freshwater fish.	Liver biopsy or necropsy. Microscopy (eggs).	Avoid eating liver of reservoir hosts. Cook such foods and fish thoroughly. Prevent children from eating dirt.
Enterobiasis (31,33, 273)	<i>Enterobius vermicularis</i> (Pinworm)	Roundworm (nematode). Free or superficially attached to mucosa of cecum, appendix, and colon.	Several months. Anal itching, local irritation due to scratching, disturbed sleep, irritability. Frequently no symptoms.	Infective eggs from human feces. Main mode of transmission: Personal contact. Crowding is an important factor. Common in children.	Any contaminated raw foods(?)	Feces (scotch tape "swab"). Microscopy (eggs).	Practice personal hygiene. Cook foods thoroughly. Dispose of sewage in sanitary manner.
Trichostrogyllosis (31,39, 287)	<i>Trichostrongylus orientalis</i> , <i>T. columbri-formis</i> , <i>T. vitrinus</i> , and other spp.	Thread-like roundworm (nematode).	Several months. Asymptomatic to gastrointestinal symptoms.	Infective eggs from animal feces. Close contact with animals important in transmission.	Night-soil contaminated vegetables (?)	Feces. Microscopy (eggs).	Personal hygiene. Cook foods thoroughly.
Echinococcoses							
Hydatidosis (Hydatid Disease) (31,33, 39,260, 280)	<i>Echinococcus granulosus</i> (Dog tapeworm) <i>Multiceps multiceps</i>	Flatworm (cestode). Hydatid cyst, 3 to 6 mm long. Eggs may survive for long periods in soil.	Several months to years. Variable, depends on site of cyst. Liver, lungs, kidney, pelvis, heart, bones, or central nervous system may be involved.	Feces (containing eggs) or cornivores (dogs and wolves) infected with adult worms. Intermediate host: larvae occur in sheep, cattle, pigs, camels, moose, deer. Dogs become infected with hydatid cysts from eating raw foods of animal origin (sheep). Main mode of transmission: contact with dogs.	Any contaminated raw food.	Serum. Serology, microscopy (scolices or cysts). X-ray.	Control slaughtering so that dogs do not have access to scraps. Control stray dogs. Incinerate or deeply bury dead animals. Deworm domestic dogs. Practice personal hygiene.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Alveolar Hydatid Disease (31,33)	<i>Echinococcus multilocularis</i>	Flatworm (cestode). Hyatid cyst, 3 to 6 mm long.	Several months to years. Jaundice, ascites, splenomegaly. Frequently fatal.	Feces of foxes, sled dogs, wolves. Maintained in a fox-vole-fox cycle. The disease is transmitted to man by consuming foods contaminated with excreta of <i>Canidae</i> , handling contaminated soil, eating dirt, or contact with infected animals.	Raw fruits and vegetables.	Serum. Serology, microscopy (scolices or cysts). X-ray.	Control slaughtering so that dogs do not have access to scraps. Control stray dogs. Incinerate or deeply bury dead animals. Deworm domestic dogs. Practice personal hygiene.
Balantidiasis (Balantidial Dysentery) (31,33, 138,295)	<i>Balantidium coli</i>	Large ciliated protozoan, cysts formed. Habitat is mucosa at lower end of large intestine. Ovoid with tapering and trophozoite; spherical or oval cyst.	Unknown. Sometimes a few days. Diarrhea with mucus, blood, pus, constipation. Necrosis and ulceration produced. Symptoms may last 1 to 4 weeks.	Swine, rats, or human feces. Contact with pigs important in transmission.	Pork, raw food.	Feces. Microscopy.	Practice personal hygiene. Cook foods thoroughly. Treat cases. Control flies.
Giardiasis (16,31,33, 138,193, 203)	<i>Giardia lamblia</i> , <i>G. intestinalis</i>	Flagellated protozoan, forms cysts, habitat in small intestine. Pear-shaped trophozoite, oval cyst.	Variable (1 to 6 weeks). Diarrhea, mucous (fatty) stools, abdominal pain and distention, nausea, vomiting, dehydration, weight loss, fever. Blocks absorption of fats. Frequently no symptoms are produced.	Cyst in human feces. Common in warm climates and in children. Transmission by personal contact and water.	Post-process contaminated salmon, possibly other unheated foods.	Feces, duodenal drainage. Microscopy.	Practice personal hygiene. Cook foods thoroughly. Dispose of sewage in sanitary manner.
Coccidiosis (Isospora Infection) (112,138)	<i>Isospora belli</i> , <i>I. natalensis</i>	Intestinal sporozoa (protozoan). Habitat is small intestine. Uses single host for alternate asexual and sexual generations. Ellipsoidal oocyst, oval sporocyst.	Approximately 8 days. Diarrhea, mucus in fecal discharge, abdominal tenderness and distention, nausea, low-grade fever, chills, anorexia, headache. Duration 10 days.	Ripe oocyst in human feces.	Raw foods.	Feces.	Practice personal hygiene. Cook foods thoroughly. Dispose of sewage in sanitary manner.

DISEASE	ETIOLOGIC AGENT	INCUBATION PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Dientamoeba Infection (31)	<i>Dientamoeba fragilis</i>	Small amebic protozoan, nonencysting trophozoite. Lives in mucosa from cecum to rectum.	Human feces.	Raw foods.	Feces. Microscopy.	Practice personal hygiene. Cook foods thoroughly. Dispose of sewage in sanitary manner.
Toxoplasmosis (31,32,33, 132,142,177, 281)	<i>Toxoplasma gondii</i>	Crescent-shaped sporozoa (protozoan). Forms cysts. Survives only a short time in extracellular environment.	Unknown. 10 to 13 days in one common-source outbreak. Source unknown. Mammals (swine, cats, cattle, sheep) and birds are reservoirs. Placental transmission occurs.	Rare hamburgers, raw or rare venison. Cysts found on meat.	Affected tissue, blood, biopsy of lymph nodes. Microscopy. Serologic and skin test, mouse inoculation.	Cook foods thoroughly. Freeze foods (5F for 24 hours). Wash hands after handling raw meat.
Sarcosporidiosis (31,39,132, 138)	<i>Sarcocystis lindemanni</i> , <i>S. (Isopora) hominis</i> , <i>S. suis/hominis</i> , <i>S. bovis/homis</i>	Protozoan. Elongated, ovoid shape with innumerable rounded and crescent-shaped spores enclosed in a membrane.	Sheep, cattle, horses, pigs, muscle fibers. Mice may be involved in transmission.	Raw meat.	Feces. Microscopy (oocyst).	Cook meat thoroughly. Freeze meat. Trichinoscopy.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Ergotism, Vascular Type (Saint Anthony's Fire) (51,93, 104,160, 200)	Ergot alkaloids from <i>Claviceps purpurea</i> . Toxic Alkaloids: Ergotamine, ergotoxins, and ergometrine groups.	Exerts marked vasoconstrictive effect on arterioles. May be tumorigenic. Organism appears as an enlarged, purple, spur-shaped body among the other seeds - Sclerotium.	1 to 2 hours. Gangrene form: Lassitude, pain in limbs, cold hands progressing to feet, burning sensation, restriction of blood supply to limbs and feet may result in gangrenous necrosis. Convulsive form: Twitchings, tonic spasm, hallucinations, convulsions. May persist for 1 to 3 months or longer	Seed grain of rye and other cereals (wheat, barley, oats), soil, air. Uncommon today.	Rye meal or bread.	Stomach contents, liver, rye. Microscopy; separation, paper chromatography. Spectrophotometry.	Hold moisture of rye below 10%. Avoid eating moldy rye.
Ergotism, Enteric Type (95)	Toxins from ergot alkaloids from <i>Claviceps fusiformis</i> of clavine group alkaloids.		Nausea, vomiting, giddiness, somnolence.	Grains of millet.	Wheat, bajra pearl millet, occurred in India.		Avoid eating moldy millet. Hold moisture of millet below 10%.
Alimentary Toxic Aleukia (ATA) (Epidemic Pannyeletoxicosis) (51,147, 179,180, 200)	Sporofusariogenin glycoside and other toxins from <i>Fusarium sporotrichoides</i> and <i>F. poae</i> . <i>Cladosporium</i> , <i>Aternaria</i> , <i>Penicillium</i> and <i>Mucor</i> spp.)	Fungi can grow and produce toxin at -2 to -10C, optimum temperature 24C. (Optimum temperature for toxic production 1.5 to 4C.) Requires 200C to destroy toxin. Toxin has destructive action on blood-forming elements of bone marrow. Nonantigenic. Reduces red and white blood cells and platelets.	Few hours. First stage: Burning sensation in mouth, tongue feels stiff, diarrhea, nausea, vomiting, perspiration. Second stage: Quiescent period. Third stage: (2 weeks to 2 months later): Leukopenia, weakness, hemorrhage of skin and mucous membranes, necrotic areas in mouth, throat, and skin; gangrenous pharyngitis, fever. Case fatality rates of outbreaks from 2 to 80%.	Soil, air. A disease of rural populations occurring mostly in the spring. Occurred in Russia. Mold produces mycotoxins during periods of repeated freezing and thawing.	Grains (millet, wheat, oats, barley, rye, buckwheat) that overwinter under snow. Bread.	Grain, blood, urine. Isolation of fungi, microscopy, extractions, animal feeding tests, and skin testing.	Thresh, wash, and mill grains. Do not allow grains to overwinter in fields. Exclude toxic grains from diet. Burn and deep-plow contaminated fields. Use fungicides on grains. Dry grains rapidly after harvest. Control moisture during storage and transportation of grains.

FUNGAL DISEASES (38-52)  
Mycotoxinoses

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Aflatoxi- cosis (49, 51, 156, 189)	Aflatoxin B <sub>1</sub> , B <sub>2</sub> , G <sub>1</sub> , G <sub>2</sub> from <i>Aspergillus</i> <i>flavus-oryzae</i> group.	These fungi are found worldwide and grow on practically any substrate. Carcinogenic to rats, ducks, and trout. Heat stable. Hepto toxin.	2 weeks or longer. Low-grade fever, jaundice, ascites, and edema of feet. Fatty infiltrations and cirrhosis of liver. 27% fatality rate in Indian outbreak.	Widespread in soil and air. Heavy rains and faulty methods of storage of grains. Reported in India, Africa, Taiwan, and Thailand.	Maize, rice, cottonseed meal, Brazil nuts, palm kernels, peanuts, soy beans, corn, wheat, other cereals, and animal feeds.	Feed, nuts, grains. Isolation of fungi, microsc- copy, extrac- tion, separa- tion and chromotography. Spectrophotome- try, animal feeding tests, and skin testi- ng.	Control moisture during storage of grains. Avoid eating moldy grains. Pre- vent damage of grains during har- vesting. Control insects. Fungicidal mold control. Remove contaminated grains or peanuts from processing line. Chemical extraction of toxin.
Liver Cancer (51)	Aflatoxins	As above.	Years. Liver cancer.	Higher incidence in low moist areas where populus in- gests large quan- tities of moldy foods than in high dry areas of Africa.	Mostly grains.	As above	As above
Acute Cardiac Beriberi (Shoshin- lakke) (49, 51)	Toxins of <i>penicillium</i> <i>citreo-viride</i> suspected.	Cardiac toxin, yellow-rice toxin. Depriva- tion of respira- tory center of medulla oblongata.	Acute heart disease. Precordial distress with palpitations and tachypnea, dyspnea, nausea, vomiting, anguish, pain, restlessness, at times violently maniacal, extremi- ties become cold and cyanotic, pupils dilate, unconscious- ness.	Retrospective study in Japan.	Polished rice.	Rice. Extract, mouse test- ing.	Reduce presence of moldy rice reaching market and avoid eating moldy rice.
Kaschin- Beck Disease (Urov Disease) (220)	Toxins from <i>Fusarium sporo-</i> <i>trichiteila</i>	Mold widespread in soil.	Chondro-esten- dystrophy (disease of bones and joints of children). Shortening of long bones, deformity of joints, flexor con- tractures, muscular atrophy. Muscular weakness and aches, joint pain, stiff- ness in extremities, paresthesia, cold- ness of hands and feet.	Soil, ahr. Occurred in Russia, Korea, Sweden, and China.	Moist grains. Bread.	Grain, blood, urine. Isolation of fungi, microsc- copy, extrac- tion, animal feeding tests, and skin testi- ng.	Control moisture during storage of grains. Do not make bread out of moldy grain and avoid eating such bread.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
"Drunken Bread" Poisoning (147)	Toxins from <i>Fusarium graminearum</i> (roseum)		Headache, vertigo, tinnitus, trembling, shaking of extremities, unstable gait. Flushed face, abdominal pain, nausea, diarrhea. Euphoria, state of confused consciousness. Milder than ATA. Duration 1 to 2 days.	Soil, air. Reported in Russia.	Grain, rye, bread.	Grain, blood, urine. Isolation of fungi, microscopy, extraction, animal feeding tests, and skin testing.	Control moisture during storage of grains. Do not make bread out of moldy grain and avoid eating such bread.
Akakabi-Byo (Red Mold Disease) (49, 51, 241)	Scirpene derivatives from <i>Fusarium nivale</i> and <i>F. graminearum</i>	Mold causes scab disease of grain.	Vomiting, diarrhea, and anorexia.	Soil, air. Reported in Japan.	Wheat flour, barley, oat, rye, rice.	Grain, blood, urine.	Control moisture during storage of grains. Do not make bread out of moldy grain and avoid eating such bread.
Balkan Endemic Nephropathy (Ochratoxicosis) (51, 136, 191, 265)	Ochratoxin A from <i>Aspergillus ochraceus</i>	Hepatotoxins, nephrotoxins.	Anemia, edema, polyuria, impairment of kidney tubular and glomerular function.	Soil and decaying vegetation. Balkan region.	Sorghum grain, corn.	Grains. Isolation of fungi, microscopy, extraction, separation chromatography.	Control moisture during storage. Avoid eating moldy grain.
Onyala (Thrombotic Purpura) (266)	Toxins from <i>Phoma sorghina</i>		Hemorrhagic bullae in mouth, thrombocytopenia, haematuria, vascular system hemorrhages.	Soil, air.	Millet and grain sorghum.	Grain. Chromatography.	Control moisture during storage of grains. Avoid eating moldy grains.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Epidemic Polyurea (Polydypsia Syndrome) Poona Disease (219)	Toxins from <i>Rhizopus nigricans</i>	Toxin is hydrophilic and heat stable.	Insidious onset, frequent urination, anorexia, thirst, weakness, fatigue, nocturia, nausea, vomiting, electrolyte imbalance, blurred vision, photophobia, palpitation, dyspnea, choking sensation, pain and cramps in limbs, giddiness. Duration 35 to 40 days with single meal exposure. Death has occurred.	Soil, air. Common in parts of India.	Pearl millet grain.	Grain, blood, urine. Isolation of fungi, microscopy, extraction, animal feeding tests, and skin testing.	Control moisture during storage. Avoid eating moldy grain.
Muco-Mycotoxic Disease (218)	Toxins from <i>Mucoraceae thurum</i>		Sporadic vomiting, hemoptysis.	Reported in India.	Wheat, flour.	Grain, vomitus. Isolation of fungus, microscopy.	Control moisture during storage. Avoid eating moldy grain.
Toxic Moldy Rice Disease (49,184)	Toxins from <i>Penicillium, Fusarium, Rhizopus, Aspergillus</i> spp.	Hepatotoxic for rodents and may induce liver tumors. Organism produces yellow pigments causing rice to appear yellow.	Long periods of incubation. Possibly acute gastroenteritis or cirrhosis and hepatoma.	Soil, air. Reported in Japan.	Yellow rice.	Grain, blood, urine. Isolation of fungi, microscopy, extraction, animal feeding tests, and skin testing.	Control moisture during storage. Avoid eating moldy rice that has turned yellow.
Moldy Ragi Poisoning (95)	<i>Heterosporium</i>		Vomiting, diarrhea.	Reported in India.	Finger millet (ragi)		Control moisture during storage. Avoid eating moldy millet.
Kodo Millet Poisoning (95)	<i>Phomopsis paspalli</i>		20 minutes and longer. Unconsciousness, delirium with violent tremors of voluntary muscles, vomiting, difficulty in swallowing, giddiness, excessive perspiration, inability to speak or swallow. Duration 24 hours.	Reported in India. Millet left in field in rainy weather.	Kodo millet		Control moisture during storage. Avoid eating moldy millet.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Cyclopeptide Poisoning (Mushroom poisoning - cell destruction type) (39,40,42)	Amanita toxin, Phallotoxins, Amanitoxins, Virosin.	Intracellular poisons. Termination of protein synthesis and cell death. Hepatotoxic. Hemolysin. Thermostable, stable to drying. Among one of the most lethal toxins known (0.1 mg/kg lethal dose), approximately 1 mushroom cap weighing 50 g.	6 to 24 hours, usually 10 to 14 hours. First phase: Sudden onset, abdominal pain, nausea, violent vomiting, continued and protracted (few days). Bloody or mucoid diarrhea, loss of strength, thirst, desiccation, muscle cramps. Feeble, rapid pulse; apathy, collapse. Second phase: Asymptomatic but cell destruction occurs (hepatic necrosis). Third phase: Jaundice, renal shutdown, cramps, drowsiness, dilation of pupils, stiff neck, twitching of facial muscles. Loss of consciousness, death due to hepatic necrosis and liver and kidney failure. Duration 3 to 10 days. Case fatality rate - 50%.	Mushrooms	Mushrooms: <sup>4</sup> <i>Amanita phalloides</i> (death angel, death cup), <i>A. brunneocens</i> , <i>A. bisporigera</i> , <i>A. ocreata</i> , <i>A. subaliacea</i> , <i>A. tenuifolia</i> , <i>A. verna</i> , <i>A. virosa</i> (destroying angel), <i>Conocybe filaris</i> , <i>Galericina autumnalis</i> , <i>G. fasciculata</i> , <i>G. venenata</i> , <i>G. marginata</i> , <i>Lepiota helveola</i>	Intact fresh mushroom, urine, blood, vomitus, stool, gastric aspirate (spores). Mince, extract, paper and thin-layer chromatography. Spectrophotometric assay. Animal inoculations of extracts. Identification of mushroom. <sup>5</sup> SCOT, SCPT, LDH, BUN, bilirubin, creatine, glucose tests.	Avoid eating toxic varieties. Discontinue in selecting edible varieties (positive identification.) As a rule cooking or drying does not destroy toxic ingredients of mushrooms. There are no foolproof tests to differentiate between toxic and nontoxic varieties. <i>Amanita phalloides</i> antitoxin available but value not established.
Orellanine Poisoning (40,42,90)	Orellanine	Protoplastic poison. Polypeptides causes renal failure.	3 to 14 days. Dry mouth, burning lips, intense thirst followed by nausea, vomiting, abdominal pain, constipation or diarrhea, chills, headache. In severe cases - insufficient renal function, polyuria followed by oliguria, anuria, albuminuria, blood in urine, drowsiness, loss of consciousness, convulsions. Case fatality rate 10-20%. Long term illness.	Mushroom tissue.	Mushrooms: <i>Cortinarius orellanus</i> <sup>6</sup>	Mushrooms, urine. Post-mortem examination. Extract, chromatography. Animal feeding tests. Identification of mushrooms. <sup>5</sup>	Avoid eating <i>C. orellanus</i> .

<sup>4</sup> Suspected etiologic agents: *Amanita magnivelaris*, *A. verna*, *A. behemica*, *Lepiota brunneoincarnata*, *L. subincarnata*, *L. castanea*, *L. felina*.

<sup>5</sup> History of eating mushrooms is important in diagnosis.

<sup>6</sup> Suspected etiologic agents: *Cortinarius gentilis*, *C. speciosissimus* (coronaria, eximia).



DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
<i>Galerina sulciiceps</i> Poisoning (42, 90)	Lethal factor.		Short. Stomach spasms, nausea, dizziness, palpitation of heart, dyspnea, local anesthesia, feeling of "pins and needles", unconsciousness, death within 7 to 24 hours.	Mushroom tissue	Mushroom: <i>Galerina sulciiceps</i>		Avoid eating <i>G. sulciiceps</i>
Monomethyl- hydrazine (Gyromitrin Poisoning) (42, 90)	Hemolytic, hepatotoxic. Toxic to CNS. Gastro- intestinal irritant. Volatile. Soluble in hot water.		2 to 12 hours, usually 6 to 8 hours. Nausea, feeling of fullness, persistent vomiting, watery diarrhea, abdominal cramps, headache, lassitude, muscular cramps, rapid pulse, high fever, dizzi- ness, faintness, loss of coordination. In severe cases, convulsions, coma, death. Case fatality rate - 15%.	Mushroom tissue. Not poisonous to all people.	"False morel" mushrooms: <sup>7</sup> <i>Gyromitra</i> ( <i>Helvella</i> ) <i>ambigua</i> , <i>brunnea</i> ( <i>H.</i> <i>underwoodii</i> ), <i>californica</i> , <i>caroliniana</i> , <i>esculenta</i> , <i>fastigata</i> , <i>gigas</i> , <i>infula</i> .	Mushrooms, blood, urine. Distill, pre- cipitate. Identification of mushrooms. <sup>5</sup> Thin layer chromatography, spectrometry.	Avoid eating false morels. Discriminate in selecting edible varieties (positive identification). Parboiling fruiting bodies for 5 minutes twice, and discard- ing water may offer some protection. Dry for over 6 months.

<sup>7</sup>Suspected etiologic agents: *Disciotis (Peziza) venosa*, *G. sphaerospora*, *Helvella (Paxina) acetabula*, *H. crispa*, *H. elastica*, *H. lacunosa*, *Morchella* spp., *Peziza babilia*, *P. succosa*, *Sarcosphaera crassa*, *Verpa behemica*.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Muscarine Poisoning - (Mushroom Poisoning - Neurological Effects) (41, 42, 48)	Muscarine	Neurotoxin. Stimulates para- sympathetic nerve endings and causes glandular secretions (cholinergic effect). Cases respond to Atropine. Toxic principle not affected by cooking.	15 to 120 minutes, usually within 30 minutes. Rapid onset. Pro- longed salivation, perspiration, tearing, peripheral vasodilation, blur- red vision, brady- cardia, nausea, vomiting, abdominal cramps, copious, watery diarrhea, slow irregular pulse, pupils constricted, muscle spasms, asthmatic breathing, cardiac or respiratory failure (rare). Sensorium ordinarily clear. Case fatality rate 6-12%.	Mushroom tissue. Occurs more fre- quently in May or June.	Mushrooms: <sup>8</sup> <i>Amanita muscaria</i> (fly agaric), <i>A. pantherina</i> (panther), <i>Clitocybe</i> <i>illudens</i> (Jack O'Lantern), <i>C. cerussata</i> , <i>C. dealbata</i> , <i>C. rivulosa</i> , <i>C. truncicola</i> , <i>Inocybe napipes</i> , <i>I. fastigiata</i> , <i>I. geophylla</i> , and its variety <i>illacina</i> , <i>I. lacera</i> , <i>I. patouillardii</i> , <i>I. pudica</i> , and many other species of <i>Inocybe</i> .	Mushrooms, urine. Mince, extract, precipitate, chromatography, identification of mushrooms. <sup>5</sup>	Avoid eating <i>Clitocybe</i> and <i>Inocybe</i> species. Discriminate in selecting edible varieties (positive identification.)
Ibotenic Acid - Muscimol Poisoning (42, 90)	Ibotenic acid, muscimol, muscazone, and other compounds.	Central nervous system effects. Sedative- hypnotic action. Flycidal effect. Anti- cholinergic effect. Atropine is contraindicated.	1/2 to 2 hours. Lightheadedness, dizziness, un- coordination, drowsiness or sleep, followed by state of excite- ment, restlessness, confusion, delirium, disturbances of vision (blurred vision), "mind- expanding" visions, muscle spasms, in- ability to perform certain acts, clouded sensorium, partial amnesia, vomiting may or may not occur. Later depression, loss of consciousness, fatigue. Recovery often rapid.	Mushroom tissue.	Mushrooms: <sup>9</sup> <i>A. muscaria</i> (fly agaric), <i>A. pantherina</i> (panther fungus), <i>A. cothurnata</i> , <i>A. gemmata</i> , <i>A. smithiana</i> , <i>A. strobiliformis</i> , <i>Tricholoma</i> <i>muscarium</i> .	Mushrooms, urine. Extract, chromatography, identification of mushrooms. <sup>5</sup>	Avoid eating <i>Amanita muscaria</i> and related varieties. Dis- criminate in selecting edible varieties (positive identification).

<sup>8</sup> Suspected etiologic agents: *A. gemmata*, *A. parviculata*, *Boletus calopus*, *B. luridus*, *B. pulcherrimus*, *B. satanus* (eastwoodiae), other spp. of *Boletus*, *C. (Hygrophoropsis) aurantiaca*, *C. nebularis*, *Hebeloma crustuliniforme*, *Mycena pura*, *Omphalotus (C) olearius* (*illudens*), *Russula emittica*.

<sup>9</sup> Suspected etiologic agents: *A. cokeri*, *Panaeolus campanulatus*, *P. refulgens*.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Psilocybin - Poisoning (Hallucino- genic Mush- room Poison- ing) (42, 90, 284)	Psilocybin, Psilocin, Baecocystin, Norbaecocystin, and Indoles similar to d-Lysergic acid.	Affects central nervous system. Psychotomnetic manifestations. Oral dose 4-8mg (2g dried mush- room). Psilocin sensitive to oxidation; psilocybin activ- ity retained in dried mushroom and extracted into boiling water.	1/2 to 3 hours, usually 30 to 60 minutes. Anxiety, difficulty concentrating and understanding, changes in sensory perception, mood elevated or de- pressed, laughter, hallucinations. In children, high fever and tonic-clinic type convulsions may develop. Resembles symptoms induced by lysergic acid diethyl- amide (LSD). Recovery in 5 to 10 hours.	Mushroom tissue. Some used in native magico- religious ceremonies. Usually grows on or near dung.	Mushrooms; <sup>10</sup> Psilocybe baecocystis, P. caerulescens, P. caerulipes, P. cyanescens, P. cubensis, P. pelliculosa, P. semilanceata, P. strictipes, P. stuntzii, Panaeolus castanifolius, P. (Copelandia) cyanescens, P. fimicola, P. foeniculii, P. sphinctrinus, P. subbalteatus, Conocybe cyanopus, C. smithii, Gymnopilus aeruginosus, G. validipes.	Mushrooms, urine. Extract, Chromatography, Identification of mushroom. <sup>5</sup>	Avoid eating the listed varieties of mushrooms. Boil and discard water.
Coprine Poisoning (Mushroom Alcohol Intolerance) (42,47,90)	Disulfiram-like (antebuse) constituents and alcohol.	Amino acid. Interferes with normal metabo- lism of alcohol. Chelating properties that bind molybdenum, block acetalde- hyde dehydroge- nase that arrests ethanol metabolism. Vasomotor effects. Sensitization requires about 3 to 6 hours.	1/2 to 2 hours. Flushing (purplish- red face), metallic taste, paresthesia of extremities, palpi- tation, dyspnea, hyper- ventilation, tachy- cardia, feeling of swelling of hands. Later, nausea, vomiting, sweating. Attacks may recur if alcohol is consumed even after 48 hours. Duration 30 minutes to a few hours.	Mushroom tissue and alcohol. Several drinks of alcohol before ingestion or one drink within 5 days of ingesting C. atramentarius.	Inky cap mushrooms. Coprinus atramentarius <sup>11</sup> and alcohol. Citocybe claviceps and beer or sake.	Mushrooms. Identification of mushrooms. <sup>5</sup> Chromatography.	Abstain from alcohol for several days after eating C. atramentarius or avoid eating C. atramentarius.

<sup>10</sup>Suspected etiologic agents: *Amanita citrina*, *A. porphyria*, *Boletus manicus*, *Clitocybe gallinacea*, *Conocybe siligineoides*, *Gymnopilus purpuratus*, *G. spectabilis*, *Lycoperdon marginatum*, *Naematoloma popperianum*, *Panaeolus campanulatus*, *P. papilionaceus*, *P. phalaenarum (solidipes)*, *P. retirugis*, *P. semiovatus (separatus)*, *Psathyrella sepulchralis*, *Russula nondorbinii*, *Stropharia aeruginosa*, *S. coronilla*, *S. hornemannii*, *S. squamosa*.

<sup>11</sup>Suspected etiologic agents: *C. micaceus*, *C. fuscescens*, *C. insignis*, some African species of *Coprinus*.

DISEASE      ETIOLOGIC AGENT      NATURE OF ORGANISM/TOXIN      INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS      SOURCE, RESERVOIR AND EPIDEMIOLOGY      FOODS INVOLVED      SPECIMENS/LABORATORY      CONTROL MEASURES

Mushroom Poisoning - Gastro-intestinal Type (42,45,47,90)  
 Unknown - probably a variety of toxic substances.  
 Gastrointestinal irritants. There is little if any liver involvement, acute nervous system stimulation, or pronounced psychic disturbance.  
 1/4 to 4 hours or longer, usually less than 2 hours.  
 Nausea, vomiting, retching, diarrhea, abdominal cramps and pain. Duration 1 to 2 days.  
 Mushroom tissue. Some are not poisonous to all people. The same variety may be eaten without ill effects on one occasion and cause illness the next.

Mushroom Poisonings - Unclassified (40,80)  
 Hepatotoxic  
 9 hours.  
 Gastroenteritis; liver and kidney damage.  
 Certain mushroom species and genera, including *Agaricus alboluteus*, *A. arvensis*, var. *Pulustis*, *A. hondensis*, *A. placomyces*, *A. xanthodermus*, *A. silvicola*.  
 Mushrooms. Identification of mushroom.  
 Avoid eating this species. Discriminate in selecting edible varieties (positive identification).

Mushroom Poisonings - Unclassified (40,80)  
 Hepatotoxic, peripheral vasodilator, metabolic poison.  
 Intense stomach pain, acute circulatory collapse, renal failure.  
*Paxillus involutus*  
 Avoid eating this species. Thorough cooking.

Mushroom Poisonings - Unclassified (40,80)  
 Heat-labile inhibits cytochrome oxidase.  
 Intense stomach pain, acute circulatory collapse, renal failure.  
*Clitocybe toxica*  
 Avoid eating this species. Discriminate in selecting edible varieties (positive identification).

12 Other species that have been implicated are *Amanita brunnescens* and its variety *pallida*, *A. chlorinosma*, *A. flavorubescens*, *A. frostiana*, *A. parviovata*, *A. rubescens* (raw), *A. spissa*, *A. spretta*, *A. vaginata* (raw), *A. volvata*, *Boletus floccosus*, *B. luridus*, *B. pulcherrimus*, (*B. eastwoodiae*), *B. satanus*, *B. sensiliis* (*miniato-olivaceus*), *Chlorophyllum molybdites*, *Clavaria formosa*, *C. gelatinosa*, *Clitocybe*, *Entoloma* (*Rhodophyllum livium* (*sinuatus*)), *E. (Nolanea) mammosum*, *E. nidorosum*, *E. pascuum* (*stauropsora*), *E. rhodopolium*, *E. salmoneum*, *E. strictus*, *E. vernum*, *Gomphus* (*cantharellus*) *floccosus*, *G. bonari*, *G. kauffmanii*, *Hebeloma crustuliniforme*, *H. fastibile*, *H. mesophaeum*, *H. sinapizans*, *Lactarius torminosus*, *L. trivialis*, *L. velleureus*, *L. chrysorheus*, *L. scrobiculatus*, *L. helvus*, *L. rufus*, *L. representaneus*, *L. uvidus*, *L. glaucescens*, *Lepiota clypeolaria*, *L. cristata*, *L. lutea*, *Leucocoprinus lutens*, *L. morgani*, *L. naucina* (*Leucoagaricus naucinus*), *Lycoperdon marginatum*, *L. subincarnatum*, *Morchella angusticeps* (*elata*), *M. crassipes*, *M. delicioza*, *M. esculenta*, *M. semilibera*, *Naematoloma* (*Hypholoma*) *fasciculare*, *Paxillus involutus*, *Paxillus involutus*, *Pholiota* (*Phaeolepiota togaria*) *aurata*, *P. squarrosa*, *Polyporus* (*Bondarzewia*) *berkeleyi*, *P. (Albatrellus) cristatus*, *P. (Grifola) giganteus*, *P. (Phaeolus) schweinitzii*, *P. (Lactiporus) sulphureus*, *Ramaria* (*Clavaria*) *formosa*, *R. gelatinosa*, *Russula emetica*, *R. foetens*, other *Russula* spp., *Scleroderma aurantium* (*cutitium*), *S. cepa*, *Tricholoma album*, *T. muscarium*, *T. nudum* (*Clitocybe nuda*) (raw), *T. pardinum*, *T. pessundatum*, *T. saponaceum*, *T. sejunctum*, *T. sulphureum*, *T. veccinum*, *T. venenatum*, *Verpa bohemica*.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Mushroom Poisonings - Unclassified (continued)			Muscular incoordina- tion		<i>Verpa bohemica</i>		Avoid eating this species. Discrimi- nate in selecting edible varieties (positive identifi- cation).
			Tetany and paraesthesia		<i>Scleroderma aurantium</i>		Avoid eating this species. Discrimi- nate in selecting edible varieties (positive identifi- cation).
			<30 minutes. Stomach pain, weak- ness, nausea, ting- ling over entire body, muscular rigidity, sweating, facial pallor.		<i>Scleroderma cepa</i>		Avoid eating this species. Discrimi- nate in selecting edible varieties (positive identifi- cation).
			Bone pain.		<i>Stropharia coronilla</i>		Avoid eating this species. Discrimi- nate in selecting edible varieties (positive identifi- cation).
Phycomycosis (Mucor- mycosis) Zygo- mycosis) (3)	<i>Absidia</i> , <i>Rhizopus</i> , <i>Mortierella</i> , <i>Basidiobolus</i> , <i>Mucor</i> , <i>Cunninghamella</i> spp.	Common sapro- phytic fungi. Opportunistic and able to cause infection because of localized or systemic factors that lower tissue resistance.	Few days. Intestinal form: Abdominal pain, diarrhea, bloody stools, mucosal ulcers, thromboses and gangrene of stomach or bowel, hematemesis, peritonitis. More frequently invades other sites: lungs, facial sinuses, brain, skin.	Soll, decaying vegetation, and moldy food. Fre- quently associated with people who have diabetes mellitus, mal- nutrition, or other illnesses. Only a few cases of mucor-mycosis of digestive sys- tem on record. Airborne trans- mission more likely.	Possibly any moldy food.	Blood, feces, biopsy or autopsy tissues. Microscopy, isolation, identification.	Avoid eating moldy food. Optimal control of diabetes mellitus.

Mycotic Infections

## PLANT TOXICANTS AND TOXINS (38, 41, 48, 53-64)

## Alkaloids

Jimson Weed or Nightshade Poisoning (41, 55, 57)	Tropane (belladonna) alkaloids: Atropine, Hyoscyamine, <sup>13</sup> Scopolamine (Hyoscyne).	Stimulant, mydri- atic, parasympatho- lytic action; blocks motor, secretory, and inhibitory effects of acetylcholine on smooth muscle tissue. Cerebral convulsant.	<1 hour. Abnormal thirst, photophobia, dilated pupils, distorted sight, difficulty speaking; hot, dry, flushed skin; rash, delirium, incoherence, coma, rapid heartbeat, cyanosis, lassitude, nausea, hallucination.	Seeds, roots, leaves, all parts of plants. Graft- ing tomato plants to Jimson weed stock caused tomatoes to become toxic.	Jimson weed, Jamestown weed, thorn apple ( <i>Datura stro- nomum</i> , <i>D. moon- tatula</i> ), moon- flower, loco- weed ( <i>D. mete- loides</i> ), deadly nighthade ( <i>Atropa bella- donna</i> ). Tea made from leaves. Grafted tomatoes.	Urine, stomach contents, plant. Extract, chromatography, colorimetry, crystal form.	Avoid eating any part of these plants. Become familiar with poisonous plants in area.
Senecio Poisoning (Veno- occlusive Disease; Bread Poisoning) (57, 60, 64)	Pyrrrolizidine alkaloids.	Inhibits neuro- muscular func- tion. Not destroyed on drying or during silage fermentation. Carcinogens and tumorigens. Alkylating agent. Heat stable.	Dyspepsia, ascites, enlarged liver, abdominal pain, nausea, vomiting, headache, apathy, emaciation, diarrhea. High case fatality rate	Seeds.	Groundsel ( <i>Senecio</i> spp.) Medicinal (gordolobo) tea, bread made from flour containi- ng with seeds. <i>Crotalaria</i> <i>nanaburn</i> millet ( <i>gondli</i> ) Wheat contam- inated by <i>Heliotropium</i> spp. seeds.	Urine, plant. Extract, chromatography, colorimetry, crystal form.	Avoid eating ground- sel seeds. De- weed fields, separate contaminated grains by sieving.
Hemlock Poisoning (55, 103)	Pyridine alkaloid: Cocaine and related compounds. Juice is the Greek hemlock poison.	Blocks spinal reflexes by action on spinal cord. Odor of parsnip.	<1 hours. Nervousness, trem- bling, ataxia, muscular weakness, dilation of pupils, slowed heartbeat, thirst, coldness, nausea, vomiting, convulsions, coma, respiratory failure.	Urtipe fruit, plant, root (conium seed). Quail feeding on this plant has been sug- gested as a cause of quail poisoning.	Poison of deadly hemlock, poison parsley ( <i>Conium</i> <i>maculatum</i> ). Fool's parsley ( <i>Aethusa</i> <i>cynapium</i> ) con- tains the same alkaloids. Mis- taken for parsley.	Urine, plant. Extract, chromatography, colorimetry, crystal form.	Avoid eating any part of these plants.

<sup>13</sup>Black henbane (*Hyoscyamus niger*) also contains hyoscyamine.<sup>14</sup>History of eating plants involved and identification of plants are important in diagnosis.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Nicotine Poisoning (41,55,57)	Nicotine Lobeline Anabasine		(See poisonous chemicals, page 66 for detailed description.)		Cardinal flower ( <i>Lobelia cardinalis</i> ) and tree tobacco ( <i>Nicotiana glauca</i> )		Avoid eating tobacco leaves or snuff.
Epidemic Dropsy (64,250)	Aregemone oil. Isoquinoline alkaloid: Sanguinarine, Berberine, Protopine.	Irritates mucous membranes, depresses smooth muscles. Dilation of capillaries. Interferes with oxidation of pyruvic acid.	Edema (particularly in low extremities), diarrhea, vomiting, pyrexia, anemia, dyspnea, tachycardia. Myocardial involvement.	Seeds and whole plant. Persons with low protein intake are more susceptible.	Prickly poppy ( <i>Argemone mexicana</i> ). Contaminated mustard oil (cooking oil), peanut oil, wheat.	Urine, plant. Extract, chromatography, colorimetry, crystal form. Animal feeding tests.	Avoid eating any part of prickly poppy. Purchase cooking oil from reliable source. Increase dietary protein.
Mescal Bean or Laburnum Poisoning (41,55,59)	Quinolizidine alkaloid: Cystisine	Similar to nicotine. Stimulation followed by depression of respiratory system	<1 hour. Salivation, nausea, vomiting, retching, diarrhea, delirium, prostration, respiratory paralysis, collapse, convulsions, coma, visual disturbances.	Seed and bean-like capsules containing seeds.	Mescal, coral bean, or Texas mountain laurel ( <i>Sophora secundiflora</i> ), laburnum, goldenchain ( <i>Cystisus laburnum</i> )	Leaves and seed pods. Extract, chromatography, colorimetry, crystal form.	Avoid eating leaves and seeds of mescal and laburnum. Prevent milk cows from grazing in areas containing scotch bloom.
Solanine Poisoning (55,57,60,64)	Solanaceous alkaloid: Solanine 16	Cholinesterase inhibitor. Exposure to sunlight increases solanine content. After ingestion, not readily absorbed, hydrolysis to free alkalines which produces dulling of senses.	1 to 6 hours. Burning of throat, nausea, stupefaction, convulsions, diarrhea, collapse, delirium, lassitude, muscular weakness.	Thripe, globular berries, leaves, sprouts, eyes, skin.	Bittersweet ( <i>Solanum dulcamara</i> ), black nightshade ( <i>S. nigrum</i> ) <sup>16,17</sup>	Urine, plant. Alkaline, extract, chromatography, colorimetry.	Avoid eating these plants. Cook solanine-containing foods thoroughly.

<sup>15</sup>Bloodroot (*Sanguinaria canadensis*) also contains Sanguinarine.

<sup>16</sup>Other plants containing solanine include Jerusalem cherry (*S. pseudocapsicum*), horse or bull nettle (*S. carolinense*), Silver leaf nightshade (*S. elaeagnifolium*), Sodom apple (*S. sodomae*), three-flower nightshade (*S. triflorum*), Day-blooming Jessamine (*Cestrum diurnum*), Night-blooming Jessamine (*Cestrum nocturnum*).

<sup>17</sup>Solanine in minute amounts in potato sprouts.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	ROADS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Green Hellebore or Death Camas Poisoning (57,60)	Steroidal, veratrum alkaloids: Veratridine, Veratrine.	Medullary excitant. Effects heart muscles and respiration. Hypotensive effect.	1 to 6 hours. Burning sensation of mouth and throat, salivation, nausea, vomiting, abdominal pain, retching, visual disturbances, cold and clammy skin, depressed circulation, hallucinations, headache, prostration.	Roots, bulbs, leaves, seeds. Mistaken for onion.	Green hellebore, false hellebore, Indian poke (Veratrum viride, V. japonicum, V. californicum). Death camas (Zygadenus spp.) Flour and soup made from green hellebore.	Plant. Extract, chromatography, colorimetry, crystal form.	Avoid eating these plants.
Delphinium or Monkshood Poisoning (41,55,57)	Polycyclic diterpene alkaloids: Ajacine, Ajacamine, Delphinine, Aconitine.	Hypotensive action. Affects nervous system (vagus nerve).	<1 hour. Tingling sensation of mouth, collapse, lassitude, prostration, visual disturbances, slow pulse, labored respiration, stiffness of facial muscles, irregular muscle twitching, depression, nausea, vomiting. Asphyxiation and respiratory paralysis is responsible for death which occurs in a few hours.	Roots, seeds, leaves. Toxicity decreases with maturity of plant. Grows in stony ground.	Larkspur, lark's claw, knight's spur (Delphinium ajacis and related species.) Monkshood aconite, friar's cap, wolfsbane (Aconitum napellus and related species) mistaken for horseradish.	Plant. Extract, chromatography, colorimetry, crystal form.	Avoid eating these plants.
Daffodil Bulb Poisoning (41,55)	Alkaloid: Lycorine	Heat stable.	Vomiting, shivering, diarrhea.	Bulb.	Daffodil (Narcissus pseudo-narcissus). Mistaken for onion.	Urine, plant or bulb. Extract, chromatography, colorimetry, crystal form.	Avoid eating the bulbs.
Yew Poisoning (41,55,57)	Alkaloid: Taxine	Cardiac depression, Gastrointestinal Irritant.	<1 hour. Nausea, vomiting, diarrhea, abdominal pain, dizziness, dry throat, muscular weakness, stupor, prostration, circulatory slowing and failure, difficulty breathing, collapse, sudden death.	Seeds, berries, foliage, needles, bark. All parts of plant.	Yew (Taxus baccata, T. canadensis, T. cuspidata, T. brevifolia).	Leaves, berries, urine. Extract, chromatography.	Avoid eating any part of this plant.



DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Strychnine and Carolina Jessamine Poisoning (41, 55, 57, 75)	Alkaloid: strychnine and compounds related to strychnine.	Depressant.	<1 hour. Convulsions, clonic phase, spasm, depression, respiratory failure, death within 24 to 48 hours.	Rodenticide bait. Nectar from flowers.	Strychnine tree ( <i>Strychnos nux-vamica</i> ), Carolina Jessamine ( <i>Coccoloba</i> ), <i>Coccoloba</i> ( <i>sempervirens</i> ). Honey.	Urine, plant. Separation, chromatography.	Avoid eating rodent bait and nectar from Carolina Jessamine.
Colchicine Poisoning (41)	Alkaloid: Colchicine	Mitotic poison, depression of cell division.	2 to 6 hours. Burning of mouth and throat, strangling, dysphagia, intense thirst, nausea, abdominal pain, violent uncontrolled vomiting, diarrhea, tenesmus, shock, collapse, hematuria, oliguria, respiratory paralysis.	All parts of plant.	Glory Lily ( <i>Gloriosa superba</i> ), Autumn crocus ( <i>Colchicum autumnale</i> ), salads, tubers mistaken for yams, seed pods, milk of poisoned livestock.	Urine, plant. Extract, chromatography, colorimetry, crystal form.	Avoid eating any part of these plants.
Peyote Poisoning (55, 199)	Alkaloid: Mescaline from peyote cactus	Hallucinogen, 350-500mg.	Changes in spatial and temporal consciousness. Visual hallucinations, anxiety, hyperreflexia of limbs, static tremors, nausea, vomiting.	Desert plant.	Peyote or mescal buttons ( <i>Lophophora williamsii</i> ).	Urine.	Avoid eating peyote buttons.
Morning Glory Poisoning (55)	Alkaloids: Lysergamide, Isoergine, Elymoclavine, and others	Hallucinogenic	Nausea, anorexia, abdominal discomfort, explosive diarrhea, polyurea, depressed deep tendon reflexes. Depersonalization, visual and tactile hallucination-like state, memory losses, feeling of transcendence.	Seeds	Morning Glory ( <i>Ipomoea violacea</i> )	Urine, plant, seeds. Extract chromatography	Avoid eating Morning Glory seeds.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Cyanide Poisoning (55, 59, 60)	Cyanogenic glycosides: Amygdalin, Prunasin, Prunasin, Prunasin	Liberates hydrogen cyanide; odor of bitter almonds. Soaking in water hydrolyzes the cyanogen in cassava.	<1 hour. Asphyxia, dyspnea, vomiting, excitement, gasping, staggering, fibrillary twitchings, paralysis, stupor, convulsions, coma, collapse, cyanosis, lassitude, prostration. Death within 15 minutes to 1 hour with lethal dose.	Glycosides Seeds.	Bitter almond ( <i>Prunus amygdalus</i> ), cassava; choke cherry, cherry, peach, wild black cherry, apricot, plum, cherry laurel pits, apple seeds, <i>Prunus sivestris</i> , apricot kernel jam, lima beans, red kidney beans, loquat plum, hydrangea buds and leaves ( <i>Hydrangea macrophylla</i> ).	Plants, stomach contents, blood, urine. Picrate test for cyanide.	Avoid eating seeds of plants involved. Cook foods thoroughly. Selective breeding of low-cyanide varieties of lima beans to those yielding less than 20 mg HCN/100 g of seed. Soak and ferment cassava.
Goiter (59)	Goitrogens: Thiocoxalidine derivatives, Thiocyanates. <sup>18</sup>	Interferes with the uptake of iodine by thyroid gland.	Enlargement of thyroid gland. Variable, depends on intake of goitrogenic substances, iodine, and other goitrogen antagonists.	Root, seed, or leaf. Dietary history.	Rotabaga, white turnip, cabbage, soybean, rape seed, peach, pear, strawberry, spinach, carrot. Milk from cows feeding on these plants.		Eat a diet containing iodine and vitamins A and D. Cook foods thoroughly. Freeze foods.
Baneberry Poisoning (40)	Protoanemonin	Gastrointestinal irritant, unstable oil. Inactivated by drying and cooking.	<1 hour. Burning sensation of mouth and pharynx, salivation, stomatitis, nausea, vomiting, abdominal pain, diarrhea, increased pulse, dizziness, convulsions, polyuria, hematuria, oliguria.	Berries, root stock, sap.	Baneberry, dolls eyes ( <i>Actaea spp.</i> ), buttercups.	Plants.	Avoid eating these plants.

<sup>18</sup>Noniodine halides, cobalt, calcium, copper, ergothione, cyanoglycosides, polysulfides, and indolylacetoneitrile are possible goitrogens.

DI SEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Buckeye (Horse Chestnut) Poisoning (55, 57)	Unknown. Coumarin glycosides, Aesculin, and Daphnin, and Saponin present.	Anticoagulant.	Blood fails to clot.	Nuts, seeds, sprouts.	Buckeye, horse chestnut ( <i>Aesculus glabra</i> and related species). Honey made from flower of California buckeye. Tea from young shoots and leaves.	Leaves and seeds.	Avoid eating the nut.
Oleander Poisoning (41, 55, 57)	Cardiac Glycosides: Thevetin, Convallarin, Steroidal, Helleborein, Ouabain, Digitoxin.	Paralyzes sympathetic nerves. Cardiotoxin stimulates heart muscles similarly to digitalis. Produces gastric distress.	1 to 24 hours. Nausea, dizziness, drowsiness, irregular heartbeat, cyanosis, collapse, coma, increased peristalsis, intestinal spasm, vomiting, diarrhea, tingling and numbness, sensation of the mouth, visual disturbances.	Kernel of fruit, sticks, wood, nectar, roots, leaves, fruit, seed.	Oleander ( <i>Nerium oleander</i> , <i>N. indicum</i> ). <sup>19</sup> Honey made from flowers. Meat roasted on oleander sticks. Milk from cow that ate foliage.	Leaves and flowers. Separation, colorimetry.	Avoid eating any part of these plants. Avoid using oleander sticks as skewers.
Pokeweed, Corn Cockle, Finger Cherry, or Chinaberry Poisoning (55, 57)	Saponins: Githagenin, Agrostemic Acid.	Emetic and cathartic action, gastrointestinal irritant, hemolytic.	<1 to 2 hours. Burning sensation in mouth, nausea, vomiting, diarrhea, gastrointestinal cramps, salivation, lassitude, drowsiness, vertigo, prostration, convulsions, visual disturbances, blindness, collapse, narcosis, paralysis, coma. Recovery usually in 24 hours.	Fruits, roots, shoots, seed. Particularly leaves and green berries.	Pokeweed root, green berries, ( <i>Phytolacca americana</i> ). <sup>20</sup> Githago, corn cockle ( <i>Agrostemma githago</i> ), finger cherry, loquat ( <i>Rhodomyrtus macrocarpa</i> ), flour contaminated with seeds. Chinaberry ( <i>Melia azedarach</i> ).	Plants.	Avoid eating any part of these plants. Parboil leaves and discard water.

<sup>19</sup>Other plants that contain cardiac glycosides are yellow oleander, be-still (*Thevetia peruviana*), Lily-of-the-Valley (*Convallaria majalis*), Strophanthus (*Strophanthus kombe*), Christmas rose, black hellebore (*Helieborus niger*), foxglove (*Digitalis purpurea*).

<sup>20</sup>Wild balsam apple (*Momordica balsamina*), baypod (*Sesbania vesicaria*), senna bean (*S. drummodii*), purple rattlebox (*S. punicea*), English ivy (*Hedera helix*), contain saponin.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Tung Nut Poisoning (6,55)	Saponin (sapotoxin) and Phytotoxin	Gastrointestinal irritant. High protein content. Two toxic fractions, one insoluble and heat labile, and the other soluble and heat stable.	<1 hour. Nausea, abdominal cramps, severe vomiting, diarrhea, prostration, dehydration, shock, cyanosis, respiratory depression, diminished reflexes may occur in severe cases.	Seed. Trees are common in Gulf Coast States.	Tung nut ( <i>Aleurites fordii</i> )	Leaves and nut	Avoid eating tung seeds or nuts.
Cycas Poisoning (57,64,170)	Azoxy Glycoside Cycasin	Carcinogenic and hepatotoxic. Multiple ingestions usually required.	6 to 24 hours. Nausea, vomiting, unconsciousness, jaundice (swelling of liver). Death within 20 hours.	Seeds or stems of cycas	Ojiya (gruel made of cycas flour and bean paste) <i>Cycas circinalis</i> , <i>C. revoluta</i> .	Vomit, seed, root or flour. Polarography; Chromotography.	Prepare flour properly, steep in water when making starch.
Red Squill Poisoning (48,63)	Glycosides Scillaren A and B	Cardiotonic and emetic action. Large dose required.	Vomiting, abdominal pain, blurred vision, cardiac irregularity, convulsions	Bulb, rodenticide	Rodent bait	Vomit	Avoid eating rodent bait
Castor Bean or Jequirity Poisoning (53,55,57,163)	Toxalbumins, hemagglutinins <sup>21</sup> (phytoalexins): Ricin in castor bean, Abrin in Jequirity.	Ability to agglutinate red blood cells and hemolytic. Antigenic. Gastrointestinal irritant, cathartic.	1 to 3 days. Burning sensation in mouth, nausea, vomiting, abdominal pain, diarrhea, lassitude, incoordinant movements, vascular collapse, kidney damage, convulsions, stupor, dyspnea, visual disturbances.	Castor: Seed of fruit, press cake and foliage to a lesser extent. Jequirity berry: drilling to make beads increases danger because core contains more abrin.	Castor bean ( <i>Ricinus communis</i> ), Jequirity bean, rosary pea, or prayer bead ( <i>Abrus precatorius</i> ).	Plants and seeds.	Avoid eating seeds (beans). Avoid putting beads made of Jequirity beans into mouth.
Favism (6,57,59)	Vicine, a nucleoside.	Susceptibility associated with a sex-linked gene. Allergic reaction. Causes hemolysis of erythrocytes.	5 to 24 hours. Headache, dizziness, vomiting, nausea, diarrhea, prostration, icterus, hemolytic (glucose-6-phosphate dehydrogenase deficiency) anemia. Sometimes fatal.	Bean. Inhalation of pollen also causes response in allergic people. Susceptibility genetically controlled.	Fava, horse, or broad bean ( <i>Vicia faba</i> ).	Blood, urine, beans.	Cook fava beans thoroughly. Avoid eating fava bean if allergic to it.

<sup>21</sup>Other toxalbumins - Croton from *Croton tiglium* (also contains a resin), curcin from *Jatropha curcas* (physic nut), and robin from *Robinia pseudoacacia* (black locust).

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS AND PLANTS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Water Hemlock Poisoning (55,56,60)	Resin: Cicutoxin.	Unsaturated aliphatic alcohol. Acts on central nervous system. Medullary excitant.	15 to 60 minutes. Salivation, nausea, severe stomach pain, mental excitement and frenzy, vomiting, frothing at mouth, irregular breathing, tremors, violent convulsions, delirium, respiratory paralysis, death.	Roots (other parts also). Roots similar to parsnip and sweet potato.	Water hemlock ( <i>Cicuta virosa</i> ). <sup>22</sup> Cowbane, beaver poison, wild parsnip, wild carrot ( <i>C. maculata</i> ). Mistaken for root vegetable.	Urine, tissue, plant.	Avoid eating any part of these plants.
Mountain Laurel, Rhododendron, or Azalea Poisoning (41,55,57)	Resin: Andromedotoxin	Emetic.	4 to 6 hours. Salivation, malaise, vomiting, diarrhea, tingling of skin, muscular weakness, headache, visual difficulties, coma, convulsions.	Shoots, leaves, and twigs.	Mountain laurel ( <i>Kalmia latifolia</i> ), Ledum (Labrador Tea), Rhododendron, Ericaceae spp. Honey made from flowers.	Leaves and flowers.	Avoid eating nectar or other parts of these plants.
Milk Sickness (6,53,55, 60,118)	Tremetol and resin acid.	Higher alcohol. Liver poison.	< 24 hours. Gradual onset. Weakness, nausea, prostration, loss of appetite, abdominal pain, vomiting, muscular tremors, acetone breath, delirium, coma, death. Hypoglycemia, acidosis occur.	Leaves and stems of plants. Causes trembles in cattle.	Milk, butter, possibly meat from cows feeding on snake-root, white snakeroot ( <i>Eupatorium rugosum</i> ). Rayless goldenrod ( <i>Aptopappus heterophyllus</i> ).	Urine, blood. Liver and kidney at autopsy. Plants.	Prevent animals from grazing in areas containing snakeroot.
Cocculus Poisoning (61)	Picrotoxin.	Non-nitrogenous substance. Stimulates central nervous system. Convulsant.	< 30 minutes. Burning pain in throat, vomiting, salivation, diarrhea, giddiness, stupor, unconsciousness, convulsions, asphyxia, heart failure, sudden death.	Seeds.	<i>Cocculus indicus</i> , fish berries, levant nut ( <i>Anamirta paniculata</i> ). Adulterated beverages.	Plants or berries.	Avoid eating berries of cocculus.

Resins

Other Toxicants, Toxins, and Allergens<sup>23</sup>

<sup>22</sup>Other *Cicuta* spp. roots are toxic.

<sup>23</sup>There are many other toxic plants that are not listed in this text; some are common house and garden plants. See references for additional data.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS AND PLANTS INVOLVED	SPECIMENS/ <sup>14</sup> LABORATORY	CONTROL MEASURES
Ackee Poisoning (Vomiting Sickness) (55)	Hypoglycin A and B (toxic peptide).	Hepatotoxins. Hypoglycemic effects. Soluble in water.	2 to 6 hours. Two forms: 1) Vomiting. Period of re- mission, 8 to 10 hours, secondary vomiting, epigas- tric discomfort, convulsions, coma. 2) Convulsions, coma (unconsciousness with restlessness and irritation to deep depression). Acidosis, low blood sugar and altered pH of blood. Mortality 40 to 80%.	Unripe fruit, seeds. A tropical tree. Reported more frequently in Jamaica. More commonly affects undernourished children.	Unripe Ackee ( <i>Bilghia</i> <i>sapida</i> ).	Blood, liver biopsy, Ackee fruit.  Clinical, toxicological.	Avoid eating unripe fruit. Cook and discard cooking water. Edible when handled properly. Eat adequate diet.
Lathyrism (59,64,95)	Lathyragens (Amino- propionitrile).	Lathyrigenic. Protoplasmic poison.	4 to 8 weeks. Muscular weakness, paralysis of legs, spastic paraplegia, tremors, osteo- porosis, skeletal changes. Posture is with feet turned in and toes down.	Pea. Occurs in people with pro- longed and monotonous diet of <i>Lathyrus</i> . Associated with conditions of poverty and drought.	White vetch, vetchling, grass pea ( <i>Lathyrus</i> <i>sativus</i> ) sweet pea ( <i>L. odoratus</i> ).	Plants.	Steep peas in hot water; discard water. Cook in large amount of water, discard excess. Eat varied diet.
Oxalate Poisoning (55,57,59, 75,175)	Oxalic acid, soluble oxa- lates. Illness perhaps due to a glycoside, anthraquinone.	Corrosive. Combines with blood calcium.	2 to 48 hours. Nausea, vomiting, abdominal pain, bloody diarrhea, stupor, swollen abdomen, headache, sommolence. Corrosive effects in the mouth or intestinal tract, gastric hemorrhage, renal colic or hematuria, convul- sions may occur with excessively large doses. Acetone breath.	Leaf, blade.	Rhubarb leaves ( <i>rheum</i> <i>rhaponticum</i> ), sorrel grass, beet tops, Indian turnip (jack-in-the- pulpit), dieffenbachia (Dumb Cane), dragon root, elephant's ear, skunk cabbage, American ivy ( <i>Parthenocissus</i> <i>quinquefolia</i> ).	Urine, plants. Extraction, precipitation, microscopic examination of crystals.	Recognition that rhubarb and other leaves of listed plants are poisonous. Avoid eating these leaves.
Manchineel Poisoning (51)	Unknown (perhaps an indole alkaloid).	Caustic.	Vomiting, abdominal pain, bloody stools, occasionally death.	Fruit, milky sap.	Manchineel ( <i>Hippomane</i> <i>mancinella</i> ).	Leaves and fruit.	Avoid eating any part of manchineel.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS AND PLANTS INVOLVED	SPECIMENS/ LABORATORY <sup>14</sup>	CONTROL MEASURES
Mistletoe Poisoning (55,57)	Choline, amines, phoratoxin.	Cholinergic, adrenergic.	Nausea, convulsions, prostration, coma.	Berries.	Mistletoe ( <i>Phoradendron flavescens</i> ), tea brewed from berries.	Leaves and berries.	Avoid eating mistletoe berries.
Nutmeg Poisoning (59,229)	Myristicin (phenol)	Stimulant, narcotic, echolic, hallucinogenic, gastroenteric irritant. Volatile oil.	1 to 6 hours. In sufficiently large doses: burning abdominal pain, euphoria, delirium, and later stupor. Low blood pressure, shock, acidosis.	Seed.	Nutmeg ( <i>Myristica fragrans</i> ).	Seeds or powder.	Avoid excessive use of nutmeg.
<i>Leucaena glauca</i> Poisoning (59,64)	Mimosine, an alpha-amino-propionic acid.	Plant able to extract selenium from soil.	Can be less than 48 hours. Loss of hair, localized edema. Feces are red color.	Leaves, pods, seed. Occurs in Indonesia.	Koa haoie ( <i>Leucaena glauca</i> ). Soup containing plant.	Feces, plant.	Avoid eating any part of plant. Cook in iron vessel.
Djenkol Poisoning (64)	Djenkolic acid, an amino acid.	Anuric; urine contains blood, epithelial cells, white crystals; disagreeable body odor.	Few hours. Vomiting, diarrhea, weakness, ataxia, photophobia, lethargy, respiration slow, deeply dilate then become pinpoint. Depressed deep tendon reflexes. Cyanosis, coma.	Seeds (beans).	Djenkol ( <i>Pithecolobium lobatum</i> ).	Urine, seeds or plants.	Avoid eating djenkol beans.
Lantana Poisoning (55)	Lantadene A and related triterpenoids.	Vomiting, diarrhea, weakness, ataxia, photophobia, lethargy, respiration slow, deeply dilate then become pinpoint. Depressed deep tendon reflexes. Cyanosis, coma.	Berries, particularly the green berry.	Berries, particularly the green berry.	Lantana, hen and chicken ( <i>Lantana</i> spp.)	Vomitus, berries.	Avoid eating Lantana berries.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS AND PLANTS INVOLVED	SPECIMENS/ LABORATORY <sup>1</sup>	CONTROL MEASURES
Plant-irritant Poisonings (55)	Generally unknown Ilicin	Irritants	30 minutes to 1 hour. Nausea, abdominal pain, severe vomiting, diarrhea, dehydration.	Bulb  Berries  Berries  Root stock, "bulb" Berries, leaves (?)	Hyacinth ( <i>Hyacinthus orientalis</i> ), Holly ( <i>Ilex</i> spp.), Yaupon ( <i>Ilex vomitoria</i> ), Iris ( <i>Iris</i> spp.) Ligustrum ( <i>Ligustrum</i> spp.)	Plant, vomitus. Colorimetry.	Avoid eating portion of plant containing toxic principle
Carotenemia (178)	High concentrations of carotene.		Yellow-orange discoloration of skin.	Green seed pod  Pod and seeds	Poinciana ( <i>Poinciana gilliesii</i> ) Wisteria ( <i>Wisteria</i> spp.)		
Red Kidney Bean Poisoning (222,234)	Unknown but contains protease inhibitor, trypsin inhibitor, hemoglobin, goitrogen, cyanogenic glycoside.	Hemagglutinating lectin	1-2 hours. Abdominal distention, nausea, vomiting, diarrhea, general weakness, recovery within a day.	High intake of yellow vegetables and fruit.  Uncooked (or cooked at low temperature) water-soaked kidney beans.	Paw paw, carrots, tomato juice.  Red kidney beans ( <i>Phaseolus vulgaris</i> ).	Plant. Extraction, chromatography.	Avoid eating excessive amounts of yellow vegetables and fruits.
Esophageal Cancer (?) (212)	Tannic acid.	Carcinogen causing chronic irritation of mucous membranes of the throat.	Throat cancer.	Epidemiologic evidence.	High tannic acid sorghum and grain in Bantu beer and porridge; perhaps the betel nut.	Beans. Test for hemagglutinins.	Cook red kidney beans.  Avoid a diet containing high tannic-acid foods.



DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>24</sup>	CONTROL MEASURES
Ciguatera Poisoning (65)	Ciguatoxin.	Neurotoxin. Toxin appears to pass through the food chain without losing its lethal activity and without harm to the carrier. Thermostable. Anticholinesterase.	3 to 5 hours, up to 24 hours. Sudden onset. Abdominal pain, nausea, vomiting, watery diarrhea, muscular aches. Tingling and numbness of lips, tongue and throat, metallic taste, dryness of mouth, perioral tingling and numbness. Anxiety, malaise, prostration, dizziness, pallor, cyanosis, chills, profuse sweating, muscular and joint pain may occur. Weakness, dilated pupils, blurred vision, temporary blindness, paralysis; deaths have occurred. Symptoms may vary greatly. Recovery usually within 24 hours, but tingling may continue for a week or more.	Several species of fish near shores and reefs. But, not all species toxic all the time. Warm, temperate to tropical regions. Usually shore or reef fish and bottom feeders. Unusually large fish of a species more commonly involved. Liver most toxic, intestines next, then gonads. Dingo-flagellate, Gambier-discus toxus possible source of ciguatoxin for fish.	Fish. Eleven orders, 57 families, and over 400 species have been incriminated. Oysters and clams. Perhaps any marine fish may be potential transmitter of ciguatoxin.	Fish gonads, liver, intestines, and muscles. Extractions, bioassay (mongoose and mouse inoculations, animal feeding, frog sciatic nerve).	Avoid eating liver, intestines, roe, and gonads of tropical fish. Avoid eating unusually large reef fish. There is no reliable method of detecting poisonous fish by their appearance. Neither frying, baking, boiling, broiling, stewing, steaming, drying, salting, nor other ordinary cooking method destroys ciguatoxin. Prohibit sale of fish that have history of ciguatoxin. In regions where ciguatera frequently reported.
Scombroid	Ichthyohemotoxin.	Destroyed when heated to 60 - 65°C. Drying does not affect toxicity. Hemolytic.	Systemic form: Diarrhea, bloody stools, nausea, vomiting, frothing at mouth, skin eruptions, cyanosis, weakness, paralysis, respiratory distress. Topical form: Burning, redness of mucosa, and hypersalivation.	Fish serum or blood. Under normal circumstances, the flesh is not toxic.	Raw moray conger, and anguillid eel blood or serum.	Serum, eel. Animal inoculations, skin or conjunctiva testing.	Avoid ingesting eel serum. Cook eels thoroughly. Care in handling to avoid cross-contamination.

<sup>24</sup>History of eating fish involved and identification of fish are important in diagnosis.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/LABORATORY <sup>24</sup>	CONTROL MEASURES
Tetraodon or Puffer Fish Poisoning (65)	Tetrodotoxin	Neurotoxin (paralysis of central nervous system and peripheral nerves). Toxin stable to boiling except in alkaline solution. Water-soluble toxin. Mainly attacks nerve endings by blocking movement of all monovalent cations.	10 to 45 minutes to 3 or more hours. Tingling or prickly sensation of fingers and toes, malaise, dizziness, pallor, numbness of lips, tongue, extremities, ataxia, nausea, vomiting, diarrhea, epigastric pain, dryness of skin, subcutaneous hemorrhage and desquamation, eyes fixed, reflex lost, respiratory distress, muscular twitching, tremor, incoordination, muscular paralysis, intense cyanosis. Case fatality rate near 60%.	Ovaries, roe, liver, intestines, and skin are most toxic, but flesh may be toxic. Toxicity is highest during spawning period. Important cause of fish poisoning in Japan. A species may be toxic in one location but not in another.	About 90 toxic species of puffer fish (fugu, blowfish, globe-fish, porcupine fish, molas, burrfish, balloonfish, toadfish).	Gonads, liver, skin, muscle of fish. Extraction, mouse inoculation.	Avoid eating puffer fish. If eaten, wash fish thoroughly when caught. Remove skin, viscera, and gonads. The sale of puffer fish in Japan is strictly regulated. Puffer fish cooks and restaurants are licensed.
Clupeoid Poisoning (Clupeotoxism) (65)	Clupeotoxin	Toxin stable to cooking, salting, and drying.	Few minutes. Metallic taste, dryness of mouth, nausea, vomiting, abdominal pain, malaise, diarrhea, cold sweat, dyspnea, cyanosis, vertigo, nervousness, numbness, muscular cramps, paralysis, convulsions, coma and death may occur. High case fatality rate.	Viscera most toxic. Fish are plankton (dinoflagellate) feeders. Apparently the fish become toxic at sporadic intervals. Spotty distribution in tropical, insular areas. Blue-green algae may be the source of the toxin.	Herring, sprat, sardine, tarpon, anchovy, bonefish, and herring-like fish of the Pacific and Caribbean.	Fish.	Avoid eating clupeoid form fish from inshore, tropical areas in the summer. Prohibit sale of suspect fish. Ordinary cooking procedures do not alter the virulence of the toxin.
File Fish Poisoning (164, 246)	Aluterin	Water soluble.	Vomiting, diarrhea, joint ache.	Believed to originate from zonatharidan <i>Palythoa tuberculosa</i> which grows on coral reefs.	File fish ( <i>Ajuteria scripta</i> ).	Fish. Feeding to pigs or mice.	Avoid eating file fish.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>2,4</sup>	CONTROL MEASURES
Elasmobranch and Chondrichthyes Poisoning (65)	Unknown. Ciguatoxin?	May be similar to that of ciguatera poisoning. Stable to heat. Toxin in flesh may be deactivated by drying.	Within 30 minutes.  Nausea, vomiting, abdominal pain, diarrhea, oily stools, pallor, headache, prostration, rapid weak pulse, burning and tingling of lips, tongue, throat, anorexia. Later, visual disturbances, pain, sensation of heaviness of limbs, chest pain, generalized itching, delirium, coma, and death may occur.	Liver, gonads, and sometimes flesh of fish.	Sharks, dogfish, rays, skates. Particularly tropical sharks.	Liver, gonads, oviducts of Elasmobranch.	Avoid eating liver, viscera, and flesh of tropical sharks, skates, and rays.
Chimaeroid Poisoning (65)	Unknown.		6 to 24 hours. Stupefying effect or mental depression.	Viscera (oviducts, liver, toe) most toxic, but flesh also toxic.	Chimaeras; ratfish, elephantfish.	Fish.	Avoid eating ratfish, elephantfish, or other chimaeras.
Cyclostome Poisoning (65)	Unknown (biogenic amine)	Anticoagulant(?), stable to heat (?) and gastric juices.	Few hours. Nausea, vomiting, diarrhea, tenesmus, abdominal pain, weakness for several days.	Skin, slime, mucus, and flesh.	Lampreys and hagfish. Fish-like vertebrates (eel-like form). <sup>25</sup>	Buccal gland secretion. Blood coagulation and hemolysis.	Deslime fish. Soak in concentrated brine for several hours (?).
Gempylid Poisoning (Gempylotoxism) (65)	Gempylid oil (Ruvettus oil).	Purgative oil containing cetyl alcohol.	Few hours, about 3. Diarrhea, no pain.	Flesh.	Snake mackerels, castor oil fish.	Fish.	Avoid eating snake mackerel or be aware of laxative effect.

<sup>25</sup>Trunkfishes (Ostraciontidae) have been reported to cause unsteadiness of gait, and Grammistid fishes cause unpleasant bitter taste and slight stinging sensation when they contact the tongue.

DISEASE	ETIOLOGIC AGENT	NATURE OF ORGANISM/TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>24</sup>	CONTROL MEASURES
Hallucinogenic Fish Poisoning (65)	Ichthyotoxin	Heat-stable toxin.	10 minutes to 2 hours. Dizziness, loss of equilibrium, ataxia, hallucination, nightmares, mental depression, sensation of tight constriction around chest. Symptoms persist for 24 hours or more.	Head or flesh. The poison is more concentrated in the head. Reef fish. Occurs in tropical Pacific and Indian Ocean regions.	Similar to those causing ciguatera poisoning. Such as mullet, goatfish, rodderfish, surgeon fish, rabbit fish, grouper.	Fish.	Avoid eating tropical reef fish that have been associated with this illness.
Fish Liver Poisoning (65)	Ichthyhepatotoxin.	Hypervitaminosis A believed to be important. Heat-stable toxin.	30 minutes to 12 hours. Nausea, vomiting, fever, headache, mild diarrhea, rash, loss of hair, dermatitis, large areas of skin peel away, bleeding from lips, joint pain.	Liver. Most outbreaks reported in Japan.	Sawara (Japanese mackerel), ishingai (sea bass, sandfish, porgy).	Urine, fish liver. Liver function tests. Assay for vitamin A.	Avoid eating liver of these fish.
Fish Roe Poisoning (65,146)	Ichthyotoxin.	Some toxins are destroyed by heat, others are not. Some are lipoprotein.	1 to 6 hours. Bitter taste, dryness of mouth, intense thirst, headache, fever, vertigo, nausea, vomiting, abdominal cramps, diarrhea, dizziness, cold sweats, chills, cyanosis. Paralysis, convulsions, and death in severe cases.	Roe and ovaries. Reported in Europe, Asia, and North America.	Carp, barbel, pike, sturgeons, gar, catfish, tench, bream, minnows, salmon, whitefish, trout, blenny, cabezon, and other freshwater and saltwater fish.	Roe, ovaries. Extraction, mouse injection.	Avoid eating roe of any fish during reproductive season. Feed to animals.
Raff or Yukuov Disease (252)	Unknown. Thiamin inactivative factor(?) Blue-green algae (?) Mercury (?)		<24 hours. Sudden, acute pains in legs, arms, and back muscles. Slight touch or movement causes cry of pain; vomiting. Urine is brownish-black color.	Flesh. Occurs in lakes following luxuriant bloom of blue-green algae.	Perch, bream, roach, turbot, lake trout.	Algae, water, fish. Microscopy. Identification of algae.	Avoid eating fish from lakes having unusually large algae growth or industrial mercury pollution.

(See Alkyl-Mercury Poisoning, page 73.)

Minamata Disease

DISEASE	ETIOLOGIC AGENT	NATURE OF TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECTIMENS/ LABORATORY <sup>26</sup>	CONTROL MEASURES
Paralytic Shellfish Poisoning (Dinoflagellate Poisoning) (65)	Saxitoxin or related compounds.	Neurotoxin blocks neuromuscular junction. Alkaloid. Relatively heat stable. During red tides, cell counts of plankton blooms may reach 20 to 40 million per ml. Produces neuro-muscular weakness without hypotension and lacks emetic and hypothermic action of tetrodotoxin. 80 µg of purified toxin per 100 g of tissue may be lethal.	< 1 hour. Tingling or burning and numbness around lips, fingertips; ataxia, giddiness, staggering, drowsiness, dryness, gripping in throat, incoherent speech, aphasia, rash, fever, respiratory paralysis (usually within 12 hours). Patients often report feeling of lightness, as floating on air.	Shellfish Mussels feed on plankton - dinoflagellates ( <i>Congaulax catenella</i> , <i>G. acatenella</i> , <i>G. tamarensis</i> , <i>Pyrodinium</i> sp.). Toxin materials are stored in various parts of the body of shellfish, digestive organs, gills, and siphons contain the greatest concentration of poison during warmer months.	Mussels, cockles, clams, soft-shell clams, butter clams, scallops, shellfish broth. Over 38 species reported to transvect dinoflagellate poison. Bivalve mussels are the most common vehicles.	Clams or mussels; sea water. Toxicological tests. Shuck, drain, grind, extract, clarify, mouse inoculation. Identify algae.	Restrict mussel gathering from toxic areas (red tides). Post warning signs. Avoid eating mussels from unknown sources. Cooking may reduce poison content, but most methods of cooking (steaming, baking, boiling, and frying) do not remove the danger. Sampling and toxin testing of mussel extracts. Prohibit marketing of shellfish that exceed an average of 400 mouse units/100 g and none that exceed 2000 mouse units.
Neurotoxic Shellfish Poisoning (65)	Toxin of <i>Gymnodinium breve</i> .	Heat stable. Stimulates post-ganglionic nerve fibers	< 3 hours. Paresthesia, hot and cold temperature sensations, nausea, vomiting, diarrhea.	Mussels feed on dinoflagellates ( <i>G. breve</i> ).	Mussels.	Mussels or clams, sea water. Toxicological tests. Shuck, drain, grind, extract, mouse clarify, mouse inoculation. Identify algae.	Monitor coastal waters for increased concentration of dinoflagellates.
Oyster Poisoning (Asari or Venerupin Poisoning) (65)	Venerupin (asaritoxin).	Stable to heat (boiled for 1 hour and still toxic). Organotropic, affecting mainly the liver.	6 hours to 7 days, usually 24 to 48 hours. Anorexia, abdominal pain, nausea, vomiting, constipation, headache, malaise, nervousness, halitosis, bleeding of mucous membranes of nose, mouth, and gums, delirium. No paralysis. High case fatality rate (33%). Death 24 to 48 hours after onset.	Toxin is concentrated in the digestive gland and liver. Dinoflagellate, <i>Exceviaella mariae-lebouriae</i> , the origin of the poison. Brackish water areas. Outbreaks restricted to Japan.	Oysters and short-necked clams (asari), <i>Ostrea (Crassostrea) gigas</i> , <i>Dosinea japonica</i> , <i>Venerupis decussata</i> .	Shellfish. Extract, chromatography, animal inoculations.	Control shellfish harvesting. Feed to test animals before eating.

<sup>26</sup>History of eating shellfish is important in diagnosis.

DISEASE	ETIOLOGIC AGENT	NATURE OF TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>26</sup>	CONTROL MEASURES
Shellfish Gastro- enteritis (291)		Fat soluble toxin. (Plankton associated?) ( <i>Vibrio parahaemolyticus</i> ?) (Norwalk agent?)	30 minutes to 12 hours. Diarrhea, nausea, vomiting, abdominal pain.	Reported in Japan.	Mussels ( <i>Mytilus edulis</i> ), scallops, <i>Patiropecten yessoensis</i> , <i>Chlamys nipponensis</i> , <i>anozara</i>	Mussels, scallops. Mouse assay, chromatography (Test for pathogenic bacteria and viruses).	Control shellfish harvesting.
Callistin Shellfish Poisoning (65)	Choline or histamine.	Allergic-like, heat stable.	Immediately on eating, up to 1 hour. Itching, flushing of face, urticaria, sensation of chest congestion, abdominal pain, nausea, vomiting, dyspnea, cough, asthmatic manifestations, hoarseness, sensation of constriction, paralysis or numbness of throat, mouth, and tongue, thirst, hypersalivation, sweating, chills, fever. Recovery in 1 to 2 days.	Ovary. Spawning season. Outbreaks restricted to Japan.	Callistin shellfish, <i>Callista brevisiphonata</i> .	Shellfish. Skin testing (Bacteriological tests.)	Avoid eating callistin shellfish during spawning season.
Abalone Poisoning (65)	Abalone viscera poison.	A photodynamic principle. Causes photosensitization, stable to boiling, freezing, and salting.	Depends on exposure to sunlight. Sudden onset. Burning and stinging sensation over entire body, prickling sensation, itching, erythema, edema, skin ulceration on parts of body exposed to sunlight.	Viscera (liver and digestive gland).	Japanese abalone, <i>Haliotis discus</i> , <i>H. sieboldi</i> .	Abalone. Animal feeding tests. Exposing abalone to sunlight.	Avoid eating viscera of abalone.
Tridacna Clam Poisoning (65)	Ciguatera(?).	Gastrointestinal vasomotor neurological disturbances.	Resembles ciguatera poisoning.	Viscera.	Clams ( <i>Tridacna maxima</i> ).	Clams.	Check with local inhabitants about history of clam-associated poisoning. If it occurs avoid eating clams.

DISEASE	ETIOLOGIC AGENT	NATURE OF TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>27</sup>	CONTROL MEASURES
Shell Poisoning (65, 246)	Tetramine.	Curare-like effects, tetramine (histamine-like), heat stable. Autonomic ganglionic blocking agent.	1 to 4 hours. Intense headache, dizziness, blurred vision, diplopia, tingling, twitching, weakness of extremities, nausea, vomiting. Anorexia, weakness, fatigue, fainting, photophobia, dryness of mouth, diarrhea or constipation may occur. Duration < 24 hours.	Salivary glands. Reported in Japan but eaten without harm in Europe.	Japanese species of shell, <i>Neptunea arthritica</i> , <i>N. intersculpta</i> , <i>Babylonica japonica</i> .	Shell. Homogenized salivary glands, alcohol extract, mice inoculations.	Remove salivary glands of shell before eating. Recognition of poisonous species. Avoid eating these species.
Cephalopod (65)	Unknown. (May possibly be bacterial - <i>Vibrio parahaemolyticus</i> ?)	Apparently heat-stable toxin.	10 to 20 hours. Nausea, vomiting, diarrhea, abdominal pain, low fever, headache, chills, weakness, paralysis, convulsions. Duration 48 hours.	Unknown.	Squid, octopus (cuttlefish?).	Flesh. Toxicological, bacteriological tests, animal feeding.	
Sea Urchin Poisoning (65)	Unknown.	Apparently formed during reproductive season.	Abdominal pain, nausea, vomiting, diarrhea, migraine-like attacks.	Gonads.	Sea urchins, <i>Paracentrotus lividus</i> , <i>Triploneustes ventricosus</i> , <i>Centrechinus antillarum</i> .	Gonads, sea urchins. Extract, animal inoculation. (Bacteriological Tests)	Avoid eating sea urchins during reproductive season.
Sea Anemone Poisoning (65)	Unknown	High molecular weight protein (?)	Few minutes. Gastritis, nausea, vomiting, abdominal pain, cyanosis, prostration, stupor, pulmonary edema, shock.	May be nematocyst apparatus or tissues of tentacles.	Raw sea anemones. <i>Radianthus paumotensis</i> , <i>Rhodactis howesi</i> , <i>Physobranchia douglasi</i> .	Sea anemone. Intraperitoneal injection or feeding mice.	Cook sea anemones. Avoid eating raw sea anemones.
Sea Cucumber Poisoning (65)	Holothurin.	Steroid glycoside. Soluble in water.	< 1 hour. Little known, but may be fatal.	Poison concentrated in the organs of Cuvier.	Few sea cucumber spp.	Organs of Cuvier of sea cucumbers. Extract, animal inoculation.	Check with local inhabitants about history of sea cucumbers being toxic. If so feed to animals before eating.

Other Marine Animals

<sup>27</sup>History of eating shellfish or marine animals and identification of species are important in diagnosis.

DISEASE	ETIOLOGIC AGENT	NATURE OF TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>28</sup>	CONTROL MEASURES
Horsehoe Crab Poisoning (Mimi Poisoning) (65)	Unknown.	Saxitoxin?	Within 30 minutes. Dizziness, headache, nausea, slow pulse, sub- normal temperature, vomiting, abdominal cramps, diarrhea, cardiac palpitation, lip numbness, pares- thesia of lower extrem- ities, weakness, sphonis, hot mouth and throat, generalized muscular paralysis, trismus, hypersalivation, drowsiness, coma.	Unlaid green eggs, flesh, or viscera during reproduc- tive season.	Asiatic horsehoe crab, other crabs and lobsters(?)	Crab. Extraction, mouse in- jection.	Avoid eating horsehoe crab during reproductive season. Check with local inhabitants be- fore eating.
Coconut Crab Poisoning (65)	Unknown.	Unknown.	Violent gastro- intestinal upset, headache, chills, joint aches, exhaustion, muscular weakness.	Coconut crab. Probably from feeding on toxic plants. Generally not toxic.	Coconut crab ( <i>Birgus</i> <i>latro</i> ).	Crab. Animal feeding.	Check with local inhabitants before eating.
Sea Turtle Poisoning (Cheloni- toxication) (65)	Chelonitoxin.		Few hours to several days (usually over 24 hours). Nausea, vomiting, upper abdominal pain, diar- rhea, weakness, vertigo, facial tachycardia, pallor, sweating, cold- ness of extremities; dry, burning, sore lips, tongue, and throat; foul breath, difficulty in swallowing, white coat- ing on tongue, may become covered with pin-sized, reddened, pustular pap- ules; tightness of chest, hypersalivation, desqua- mation, headache, somno- lence, coma, death. High case fatality rate (28%).	Greatest concentra- tion in liver, but also in flesh, fat, viscera, and blood. Sporadic. Perhaps poison is derived from toxic marine algae. Most out- breaks from Indo- Pacific region.	Green sea, hawkbill, and leather- back turtles.	Turtle meat. Extract, animal feed- ing or in- jection.	Eat tropical turtles with caution. Avoid the liver. Feed sus- pect turtle meat to animals 24 hours be- fore attempting to

<sup>28</sup>History of eating marine animals and identification of species are important in diagnosis.



DISEASE	ETIOLOGIC AGENT	NATURE OF TOXIN OR POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>28</sup>	CONTROL MEASURES
Asiatic Porpoise Poisoning (65)	Unknown.		Abdominal pain and distention, swelling and numbness of tongue, loss of vision, cyanosis, areas of skin, hypersalivation, greenish tinge of saliva, muscular paralysis. Death is common.	Liver, eyes, blood, viscera, and flesh.	Asiatic porpoise, <i>Neophocaena phocaenoides</i> .		Avoid eating Asiatic porpoise.
Sei Whale Poisoning (65)	Unknown.	Histamine-like substance.	Within 24 hours. Severe occital headache, neck pain, flushing and swelling of face, nausea, vomiting, abdominal pain, diarrhea, fever, chills, photophobia, epiphora, erratic blood pressure, desquamation of skin of face and neck.	Liver.	Liver of Sei whale ( <i>Balaenoptera borealis</i> ). (White whales are also reported as being poisonous).	Urine, liver. Animal feeding.	Avoid eating liver of Sei whale.
Hyper-Vitaminosis A (65)	Excessive Vitamin A	Cooking does not destroy toxic principle.	1 to 6 hours. Intense throbbing or dull frontal headache, nausea, vomiting, diarrhea, abdominal pain, dizziness, drowsiness, irritability, weakness, collapse, light sensitivity, convulsions, insomnia, desquamation of skin.	Liver and kidney. Occurs in Arctic regions. Toxicity varies with individual animal.	Sled dogs, Arctic foxes, bearded seals, sea lions, bull rogue walrus, polar bears. Perhaps porpoises, whales, sharks and certain fish.	Liver, kidney. Assay for vitamin A.	Avoid eating liver of animals from cold regions.

Non-Marine Animals

Other crab poisonings produce symptoms similar to either ciguatera or tetraodon.<sup>29</sup>

<sup>29</sup>Xanthid crabs: *Zorgmus aeneus*, *Platypodia granulosa*, *Atergatis floridus*, *Eriphia* spp; *Angatea* spp., *Demania toxica*, *Carpilius maculatus* (H).

DISEASE	ETIOLOGIC AGENT	NATURE OF TOXIN	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY <sup>28</sup>	CONTROL MEASURES
Toxic Quail Poisoning (Coturnism) (59, 224, 300)	Eliciting factor, conine alkaloid(?)	Individual possesses a sensitivity possibly caused by enzymatic abnormality. Quail fed hemlock seeds are toxic to dogs. Toxic metabolites accumulated by quail during stress of migration may be responsible.	1-1/2 to 3 hours for active people; 7 to 9 hours for people at rest. Nausea, vomiting, chills, sharp muscu- lar pain, myoglobi- nuria (red urine), oliguria, anuria, atolemia, partial slow-spreading paralysis.	Exertion and fatigue are predisposing factors that shorten incuba- tion period and aggravate the disease. European and African regions.	Quail.	Quail, urine. Animal feeding.	Avoid eating Middle Eastern Quail when excessively fatigued.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Zinc Poisoning (70,107,162)	Soluble zinc salts.	Astringent, corrosive, and emetic.	10 minutes to 3 hours. Pain in mouth, throat and abdomen, nausea, vomiting, dizziness, collapse, shock, glottic edema, albuminuria, nematuria.	Zinc-coated (galvanized) containers (pots, cans, tubs). Acids convert zinc into soluble zinc salts.	Lemonade, cooked apples, washed potatoes, spinach, chicken, tomatoes, and fruit punch.	Food containing, vomitus, stomach contents, urine, blood, feces. Oxidize sample extract zinc, colorimetry or ash, dissolve, atomic absorption spectrometry.	Avoid using galvanized containers to store or to cook high-acid food or beverage.
Cadmium Poisoning (6,70,75,162)	Inorganic salts of cadmium. (See page for information on chronic cadmium poisoning.)	Gastrointestinal irritant. Kidney and liver damage.	15 to 30 minutes. Nausea, vomiting, cramps, diarrhea, retching, shock, headache, vertigo, sensory disturbances in hands and arms, convulsions, and prostration reported in severe cases.	Cadmium-(rust-proof) plated utensils (ice cube trays, pitchers), red, orange, or yellow glazed pottery or steel. Foods left in cadmium containers for as little as 1-1/2 hours have caused poisonings. Main mode of transmission: Inhalation of fumes.	Lemonade, punch, fruit gelatin dessert, pop-sicles.	Food, containing, vomitus, stomach contents, urine, blood. Digest sample, separate cadmium, photometry.	Avoid using cadmium-plated containers to store or to cook high-acid food or beverages.
Antimony Poisoning (6,70,75,162)	Antimony salts, antimony trioxide.	Emetic and irritating to mucous membranes. 18 ppm can cause symptoms.	15 minutes to 1 hour. Bitter taste, nausea, vomiting, abdominal pain, diarrhea, muscular pain, irregular respiration, lower temperature, collapse. Usually mild and short in duration.	Glaze of cheap, gray enameled cooking utensils containing antimony oxide. Opacifier remains dispersed in the vitreous coating. Readily attacked by acids.	Lemonade, punch, fruit gelatin dessert, sauerkraut, pop-sicles.	Food, containing, vomitus, stomach contents, urine, blood, feces. Digest sample, spectrophotometry.	Avoid using utensils containing antimony to store or to cook high-acid food or beverages.
Copper Poisoning (70,75,122,162)	Copper salts.	Emetic, irritant, and astringent.	Few minutes to 8 hours. Metallic taste, nausea, vomiting, diarrhea, abdominal pain, hematemesis, hematuria, convulsions. Vomitus is often blue-green color.	Copper pipes, copper containers, copper cake decorators.	Carbonated beverages, high-acid food. Cakes decorated with copper bands.	Food containing, vomitus, stomach contents, urine, blood. Digest sample, isolate copper, colorimetry or ash, dissolve, atomic absorption spectrometry.	Avoid using copper pipes and containers in contact with high-acid food or beverages. Prohibit use of copper cake decorators.

POISONOUS CHEMICALS (53,69-79)

Metallic Containers

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Lead Poisoning (Plumbism) (75,158,162)	Lead and soluble lead salts.	Local irritant to alimentary tract in acute poisonings. Organ failure in chronic poisonings.	30 minutes and longer. Metallic taste, burning of pharynx, abdominal pain, vomiting (milky), diarrhea (stools may be bloody or black) or constipation, foul breath, salivation, headache, shock, weakness, general aching and stiffness, insomnia, vertigo, anemia, blue line where teeth meet gums.	Lead containers, lead water pipes, auto radiators used as condensers, putty, pesticides, and lead glazes for pottery. Sugar of lead (formerly used to stop fermentation of wine). Inhalation of fumes more common mode of transmission	High-acid fruits, wine, maple syrup, beer, cider, vinegar, sardines, ice, moonshine whiskey, curry powder.	Food container, vomitus, stomach contents, urine, blood, stools, hair.	Avoid using lead containers in contact with food or for distillation.
Tin Poisoning (86,282)	Tin		<1/2 to 2 hours, or longer. Bloating, nausea, abdominal cramps, vomiting, diarrhea, headache.	Tin containers, mostly re-timed milk containers. Only a few reported outbreaks. Nitrates present cause excessive corrosion of tin lining of cans.	High-acid food: cherries, punch, herring, tomato juice.	Food, container, feces, vomitus, stomach contents, urine, blood.	Avoid using uncoated tin containers to store high-acid food. Avoid excessive nitrification of crops having high-acid fruits during production.
Iron Poisoning (Bantu siderosis) (3,162)	Iron salts.	Iron overload.	Years. Skin (bronzing) pigmentation, liver disease, diabetes, cardiac failure.	Excessive dietary iron intake from iron pots. More frequent in males.	Beer, wine.	Urine, blood, liver biopsy. Photometry.	Avoid excessive intake of iron. Do not ferment and store beer or wine in iron containers.
Monosodium Glutamate Poisoning (Chinese Restaurant Syndrome) (267)	Monosodium glutamate (MSG).	Flavor intensifier.	Few minutes to 1/2 hour. Numbness, pressure, tingling sensations in scalp, back of neck, sides of face, jaw, arms, legs, flushing, dizziness, blurred vision, restlessness, headache, nausea. Duration < 24 hours, usually 2 to 7 hours.	Intentional Additives Monosodium glutamate. One teaspoonful of MSG can cause symptoms in susceptible people is stomach is empty. Women are more susceptible.	Chinese restaurant food (soups, port with Chinese vegetables, chow mein, egg roll, lobster, boiled rice, sauce).	Foods. Liquify, filter, potentiometry.	Avoid excessive use of MSG. Restrict use of MSG in baby food. Ingestion of food before ingestion of MSG delays absorption of MSG.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Nitrite Poisoning (75,141)	Nitrites and nitrates. <sup>30</sup>	Interferes with oxygen-carrying capacity of red blood cells. May form nitrosamines which are carcinogenic in vivo.	1 to 2 hours. Nausea, vomiting, cyanosis (blueness of lips and adjacent areas, fingers near nails), rapid breathing, fall in blood pressure, headache, dizziness, dyspnea, trembling, convulsions may occur, weakness, loss of consciousness, methemoglobinemia, chocolate brown discoloration of blood.	Soil, fertilizer, color developer for processed meat. Also transmitted by rural well water supplies. Lack of acidity in the gastrointestinal tracts of infants permits nitrate-reducing organisms to grow and convert nitrates to nitrites.	Processed meat and fish, beef- tea. Nitrites mistaken and used for salt. Milk formulas. Spinach and other plants with excessive fertilization.	Blood, suspect food. Oxidize, extract, colorimetry.	Restrict use to 50 ppm in processed meat. Avoid excessive fertilization. Refrigerate fresh and cooked leafy vegetables.
Niacin Poisoning (233)	Niacin (nicotinic acid), sodium nicotinate.	Causes sudden cutaneous vasodilation.	Few minutes to 1 hr. Intense flushing of skin, warm feeling, itching, abdominal discomfort, puffing of face and knees. Brief episodes.	Color preservative, vitamin additive.	Meat, cornmeal.	Suspect food. Neutralize, precipitate, colorimetry.	Restrict use as meat preservative. Control amounts of additives and thorough mixing.
Triorthocresyl phosphate Poisoning (256,262)	Triorthocresyl phosphate, triaryl phosphates.	Neurotoxic - paralysis of motor nerve trunks.	5 days to 3 weeks (10 days). Leg pain and tenderness, motor weakness, ungainly high-stepping gait, loss of voluntary movements below knees, residual paralysis - food and wrist drop. May be preceded by nausea, vomiting, abdominal pain or diarrhea. Recovery is slow and incomplete.	Lubricating oil, certain plastic (non-food use) containers, refrigerant for machine guns, hydraulic fluid.	Cooking oil substitute, fluid extract of ginger (Jamaica ginger), apiol (parsley extract), contaminated flour.	Suspect foods. Autopsy: (myelin sheath and spinal cord lesions). Biopsy: (gastrocnemius muscle). Infrared spectrography, chromatography. Feeding chickens.	Avoid use in foods. Store foods away from poisonous substances.
Phenolphthalein Poisoning (53,159)	Phenolphthalein.	Cathartic.	1 to 2 hours. Vomiting, diarrhea.	Coloring agent, pH indicator.	Candy brooms, cake.	Vomit, food. Color reaction in alkaline water.	Avoid use in food.

<sup>30</sup>Bacteria that reduce nitrates to nitrites include: Enterobacteriaceae, staphylococci, pseudomonads, *B. subtilis*, and *C. perfringens*.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Arsenic Poisoning (Acute) (70,75)	Arsenic (trivalent or pentavalent)	Systemic action on capillaries, corrosive, with chelates with dithiols. Protoplasmic and vascular poison.	10 minutes to several days. Burning of mouth or throat, metallic taste, vomiting, diarrhea (watery and bloody), borignmi, painful tenesmus, hema- turia, dehydration, jaundice, oliguria, collapse, shock. Headache, vertigo, muscle spasms, stupor, delirium may occur.	Pesticide sprays contaminate food. Weck killers.	Fruit and vegetables, contaminated soft drink, syrup, beer, wine, cocoa, dry milk. Mistaken for sugar, baking powder or soda. Well water also involved.	Gastric washings, urine, blood, hair, nails, feces. Digest, isolate arsenic, distill, colorimetry.	Apply only to seedlings. Label and store in an area separate from food.
Arsenic Poisoning (Chronic) (Peripheral neuritis) (70)	Arsenic trioxide	Protoplasmic poison. Chromosomal damage.	Several days or weeks. Loss of weight, loss of appetite, nausea, diarrhea alternating with constipation, pigmentation and eruption of skin, hair loss, peripheral neuritis.	Sugar formerly used for brewing beer.	Grain, wine, beer, sugar	Urine, feces. Digest, isolate arsenic, distill, colorimetry.	Avoid eating arsenic-contaminated foods.
Beer Drinkers' Cardio-myopathy (162,202,211)	Cobalt acetate.	Cutaneous vasodilator.	2 months to several months. Sudden onset. Dyspnea, weakness, fatigue, edema, neck vein distention, tachycardia, gallop rhythm, tachypnea, orthopnea, chest pain, cough, congestive cardiac failure.	Improver for head of beer.	Beer.	Blood, urine, feces, hair. Heart muscle at autopsy. Serum glutamic ovaloacetic acid, lactic dehydrogenase, lactic acid levels, electrocardiogram. Ash dissolve, colorimetry.	Prohibit use of cobalt compounds in beer, eat adequate protein diet. Avoid continued, excessive consumption of beer.
Potassium Bromate Poisoning (227)	Potassium bromate.	Caustic and nephrotoxic. Slowly excreted.	1/2 to 2-1/2 hours. Nausea, vomiting, abdominal cramps, diarrhea, collapse, convulsions, anuria. Methemoglobin formation and hemolysis may occur.	Bread improver, permanent wave kits.	Bread, cake or sugar (contaminated with chemical).	Blood, urine. Colorimetry or titration. Urinalysis.	Avoid keeping potassium bromate in food storage areas.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Margarine Disease (Plants) Disease, Blaschem- krantheit) (130)	Emulsifier "HE18"	Allergen.	1 hour to several days. Acute onset. Red macules on face, neck, and hands, spreading to other areas within 2 to 24 hours, especially upper extremi- ties. Occasionally a purple swelling of face, hands, and feet - hemorrhage in center of lesions. Fever, headache, difficulty swallowing; edematous cheeks, lips, gums; blood blisters; lesions around mouth.	Chemical emulsi- fier (keeps fat from spattering during frying.	Margarine.	Blood.	Withdraw product from markets. Prevent use in food products.
Methyl paraben Poisoning (245)	Methyl Paraben.	Preservative and antiseptic.	Few seconds to 2 hours. Burning sensation of mouth, tongue, and lips, numbness, mouth sores, headache, nausea, diarrhea.	Mold retardant used in food, drugs, and cosmetics. Anti- bacterial agent for 'mutilis' control.	Cake icing.	Vomitns. Uv. absorbance; Paper or gas chromatography.	Avoid excessive use of mold retardants.
Diphenyl- hydantoin Intoxi- cation (116)	Diphenyl- hydantoin.		30 to 90 minutes. Fatigue, nausea, changes in perception and coordination, dizziness, headache, diplopia, dry mouth.	Epilepsy drug.	Coffee.	Urine.	
Organic Phosphorus Poisoning (75,166,167, 182,215)	Organic alkyl and/or aryl phosphate esters. Para- thion Tetrathyl pyrophosphate (TEPP), Carbo- phenothion (Trithion), Diazinon, Malathion Ronnel <sup>1</sup>	Irreversibly inhibit cholinesterase and allow accumulation of acetylcholine. Among most toxic chemicals known.	Few minutes to 8 hours. Nausea, vomiting, abdominal cramps, diarrhea, excessive salivation, headache, giddiness, nervous- ness, blurred vision, weakness, chest pain, tearing, respiratory tract secretions, cyanosis, papilledema, confusion, uncontrol- lable muscle twitching, convulsions, coma, loss of reflexes and sphincter control.	Insecticides.	Parathion: wheat, barley flour, bread, pastry, cereal, sugar. Carbophenothion: tortillas. Diazinon: Mio- taken for wine, doughnut mix. Any food acci- dentally con- taminated with these insecti- cides.	Blood, urine, fat biopsy.	Avoid spraying just before harvest. Label and store insecticides in an area separate from food. Wash or blanch food. Patients respond to atropine sulfate.

Incidental and Accidental Food Additives

<sup>1</sup>Methylparathion, Tetram, Sarin, Tabun, Paraoxon, Thionex, HETP, Systox, EPN, DDVP, DFP, Phorate, Phosdrin, Chlorthion, Dopterex, Abate, Coumaphos, DeNav, Guthion, Pestox, Octamethyl pyrophosphoramide (OMPA), Desecon, Mevinphos, Disulfoton, Azinphosmethyl, Chlorfenuinphos, Dichlorvos, Dimethate, Trichlorfor, Chlorothion are examples of other organic phosphorus insecticides.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Chlorinated Hydrocarbon Poison (Cutana tarda porphyria) (75,124,166, 167,215,231)	Halogenated hydrocarbons. DDT, Benzene Hexachloride, Lindane, Toxaphene, Dilan, 2-4-D, Methoxychlor, Chlorobenzilate.	Stimulates central nervous system. Liver poison. Fat soluble, insoluble in water. Prolonged storage of DDT in mammals. Hexachlorobenzene: porphyric.	1/2 to 6 hours. Nausea, vomiting, paresthesia of tongue, lips, parts of face and extremities. Apprehension, disturbance of equilibrium, dizziness, confusion, muscular weakness, anorexia, weight loss. Inhalated vapor of Lindane: severe headache, nausea, irritation of eyes, nose, and throat. Hexachlorobenzene: (Pink-like lesions on infants). Skin ulcerations and pigmentation, increase in body hair, dark urine that has fluorescence, painless arthritis, inability to perform certain movements, abdominal pain, death.	Insecticides. Spray applications. Overheated thermal insecticide vaporizers. Hexachlorobenzene fungicide.	BHC: Seed grain, grain, bread made from treated grain, maternal milk. Toxaphene: leafy vegetables. Any food accidentally contaminated with insecticides.	Blood, urine, feces, fat biopsy, stomach contents. Extraction. Phenate ion formations, chromatography	Avoid spraying just before harvest. Label and store insecticides in an area separate from food. Wash or blanch food. Restrict use of Lindane vaporizers and DDT.
	Aldrin, Dieldrin, Isodrin, Endrin, Chlordane, Heptachlor.	Stimulates central nervous system.	1/2 hour or more. Similar to above but without paresthesia.	Insecticides.	Endrin: flour, bread, cola. Any food accidentally contaminated with insecticides.	Blood, urine, feces, fat biopsy, stomach contents. Food: extract fat, colorimetry.	Label and store in an area separate from food. Avoid storing insecticides in reusable containers.
	D-D, Nemagon.	Depresses central nervous system and irritates respiratory system.	Nausea, vomiting, abdominal pain, gasping, dyspnea, irritation of respiratory tract, pulmonary congestion and edema, coughing, marked depression of central nervous system.	Soil fumigant.	Any food accidentally contaminated with fumigant.	Blood, urine, feces, fat biopsy, stomach contents.	Label and store in an area separate from food. Avoid spraying just before harvest.



DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Carbamate Poisoning (75,167,215)	Carbaryl (Sevin) Baygon (Propoxur) Mobam, Temik (Aldicarb), Zectran	Reversible inhibitor of cholinesterase.	1/2 hour. Epigastric pain, vomiting, abnormal salivation, sweating, contraction of pupils, muscular incoordination.	Insecticides.	Cucumbers, flour, Bread.	Blood, Blood. Extraction, chromatography, colorimetry.	Label and store in an area separate from food.
Fluoride Poisoning (75,198, 255,290)	Sodium fluoride.	Fluorine is the most reactive chemical element. Direct cellular poison, interferes with calcium metabolism and enzyme mechanisms.	Few minutes to 2 hours. Salty or soapy taste, numbness of mouth, thirst, nausea, vomiting, diarrhea, abdominal burning and cramps, collapse, pallor, weakness, weak pulse, shallow respiration, wet and cold skin, cyanosis, dilated pupils, spasm, shock, death.	Roach and rat poison.	Contaminated scrambled eggs, flour, mistaken and used for baking soda, baking powder, and dry milk.	Foods, vomitus, stomach contents. Ash, dissolve fluoride ion electrode.	Color code insecticides. Label and store roach powder in an area separate from food.
Sodium/ Monofluoroacetate Poisoning (75,166,167)	Sodium monofluoroacetate (1080).	Cardiovascular or nervous system toxin.	1/2 to 2 hours. Nausea, vomiting, mental apprehension, epileptiform convulsions, cardiac arrest or ventricular fibrillation, death may occur.	Rodenticide.	Any food accidentally contaminated with rodenticide.	Blood, organs. Wash, extract, chromatography, fluoride ion electrode, mass spectroscopy.	Prohibit use.
Thallium Poisoning (70 75,84, 166,167)	Thallium sulfate.	Cellular toxin.	12 to 24 hours. Gastroenteritis: abdominal pain, vomiting, diarrhea (bloody), anorexia, stomatitis, salivation, weight loss. Neurological and other symptoms: paresthesia, headache, cranial nerve damage, insomnia, convulsions, delirium, coma, vascular collapse and death may occur. Loss of hair.	Rodenticide.	Barley grain and any food accidentally contaminated with rodenticide	Urine, blood. Ash, dissolve atomic absorption spectrometry.	Restrict use. Label and store in an area separate from food.
Warfarin Poisoning (75,166,167)	Warfarin.	Anticoagulant, inhibits prothrombin formation, capillary damage.	7 to 10 days. Back and abdominal pain, vomiting, nose bleeds, bleeding gums, pallor, petechial rash, massive bruises, extensive blood loss (seen in urine and feces), shock.	Rodenticide. Consumption of poisoned bait.	Corn meal. Any food accidentally contaminated with this rodenticide and eaten over a period of several days.	Blood, urine stomach contents, Extract, Spectrophotofluorometry.	Label and store in an area separate from food. Vitamin K treatment.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Phosphide Poisoning (75,166,167, 264)	White or yellow phosphorus, zinc phosphide.	Hydrogen phosphide (phosphine) re- leased when stomach hydrochloric acid reacts with phos- phide or phos- phorus. Gastro- intestinal irri- tant.	1/2 to 9 hours. Burning pain, thirst, nausea, vomiting, diarrhea, abdominal pain. Symptom-free stage, then pro- tracted vomiting and diarrhea, hema- temesis, jaundice, hepatomegaly, oli- guria, convulsions, delirium, coma, shock, severe damage to liver, heart, and kidneys. Death may occur. Characteristic odor of garlic to breath and vomitus. Greenish-black lumi- nescent sputum, vomitus, and feces.	Rodenticides, match heads.	Barley. Any food acci- dentally con- taminated with this pesticide.	Vomitus, feces, Label and store in urine, blood. an area separate from food. Urinalysis, liver function tests. Ash, dissolve, photometry.	
Barium Poisoning (70,75, 162,223)	Barium carbonate	Causes local irritation, peripheral vaso- constriction, digitalis-like action on heart, and paralysis of central nervous system.	1 to 8 hours. Excessive salivation, vomiting, abdominal cramps, diarrhea (watery and bloody), tingling sensation of face and neck, loss of tendon reflexes, twitching, disordered action of heart muscles, paralysis, weakness, collapse, respiratory difficulty and failure.	Rodenticide.	Flour, bread, pastry tarts, potato starch, sausage. Any food contami- nated with this pesticide.	Urine, feces. Autopsy: stomach and bowel con- tents, liver, bone. Precipitate, colorimetry.	Label and store in an area separate from food.
Nicotine Poisoning (41,75)	Nicotine sulfate.	Alkaloid that is caustic. Stimulates and then depresses central nervous system. Cerebral convulsant. Carcinogenic.	Burning sensation in mouth, anxiety, excitement, salivation, nausea, vomiting (odor of stale nicotine), diarrhea, abdominal pain, headache, visual disturbances, confusion, weakness, collapse, coma, convulsions, respira- tory failure, flaccidity of muscles.	Insecticide. Tobacco products.	Any food acci- dentally con- taminated with this pesticide. Mustard, cigarette butts.	Urine, Autopsy: stomach con- tents, liver, kidney. Extract, distill, separate, spectro- photometry.	Label and store in an area separate from food.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Red Squill Poisoning	(See Glycocides, Plant Toxicants and Toxins, page 72)						
Strychnine Poisoning	(See Alkaloids, Plant Toxicants and Toxins, page 72)						
Epoxy Resin Poisoning (188)	4,4'-diaminodiphenylmethane.	Aromatic amine polyester.	Abdominal pain, jaundice, fever, malaise, muscular pains.	Epoxy resin hardener. Spillage during transit.	Cereal grains.	Liver biopsy.	Avoid storing and transporting resin or catalyst with food.
Calcium chloride Poisoning (269)	Calcium chloride.	Corrosive.	Few minutes. Nausea, vomiting.	Brine from freezer tank.	Popsicles.	Vomitus.	Properly install vending machine water lines. Prevent cross-contamination.
Chromium Poisoning (162,267)	Sodium dichromate, trisodium phosphate, and sodium hydroxide.	Irritating and corrosive.	15 minutes. Vomiting, severe abdominal cramps, anorexia.	Rust and corrosion preventive compound (vending machine hooked up to hot water line).	Soft drinks.	Vomitus, urine. Ash, spectrophotometry.	Properly install vending machine water lines. Prevent cross-contamination.
Cyanide Poisoning (75)	Compounds containing cyanide	Corrosive in stomach. Inhibits cytochrome oxidase system for oxygen utilization in cells.	1/2 to 6 hours. Nausea, vomiting (peach pit odor), diarrhea. Death caused by asphyxiation.	Silver polish (questionable transmission from this source). Fumigant for rats.	Any contaminated food.	Blood, urine. AgNO <sub>3</sub> precipitation, titration.	Avoid use of silver polish containing cyanide for food contact surfaces. Store in area separate from food. Label.
Lye Poisoning (53,75,270)	Sodium hydroxide.	Caustic (high pH). Corrosive.	Few minutes to 12 to 14 hours. Burning of mouth, nausea, vomiting, edema of pharynx and larynx, collapse, coma may occur with high concentrations. Abdominal pain, diarrhea with low concentrations.	Drain cleaners, paint removers, hair straighteners, cleaners, agents, washing compounds in bottling plants.	Any contaminated food.	Vomitus, food. Measure pH; add AS <sub>2</sub> O <sub>3</sub> and titrate.	Label and store in area separate from food. Avoid using food containers for storing lye.
Soap Poisoning	Soap	Caustic.	Few minutes. Burning of tongue, mouth, and vocal cords.	Soaps.	White wine bottles used to store soap solutions.	Vomitus. Separate, extract, dissolve, weight as fatty acids.	Avoid storing soaps and detergent solutions in empty wine bottles or other food containers. Label and store in an area separate from foods.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Anionic Detergent Poisoning (53)	Anionic detergent	Irritant	Few minutes. Vomiting and diarrhea.	Detergents.	Empty wine or soft drink bottles used to store detergent solutions.	Vomitus.	Avoid storing soaps and detergents in empty wine or soft drink bottles or other food containers. Label and store in an area separate from food.
Cationic Poisoning (53)	Cationic detergent	Interferes with cellular functions	Few minutes. Nausea, vomiting, shock, coma, convulsions, death.	Sanitizers, detergents.	Empty wine or soft drink bottles used to store detergent solutions.	Vomitus.	Avoid storing soaps and detergents in empty wine or soft drink bottles or other food containers. Label and store in an area separate from food.
Methyl alcohol Poisoning (75, 92)	Methyl (wood) alcohol.	Central nervous system depressant causes acidosis by inhibiting oxidative enzyme system.	8 to 72 hours. Vomiting, severe abdominal pain, depression, weakness, headache, dimness of vision, dyspnea, coma, cyanosis. Cerebral edema, optic neuritis, blindness, oliguria.	Paint solvent, denaturant in rubbing alcohol, antifreeze.	Ethyl alcohol substitute. Bootleg whiskey.	Urine, vomitus, blood, tissues after autopsy.	Avoid drinking wood alcohol. Store in an area separate from food. Label and add dye.
Alkyl-mercury Poisoning (65, 125, 129, 162, 192, 259, 271)	Mercuric chloride - vinyl complex. (see page for more information about mercury poisoning.)	Central nervous system involvement. Bacterial conversion of mercury to methyl mercury. Causes degenerative changes in kidneys.	1 week or longer. Progressive numbness of extremities, lips, and tongue; ataxic gait, weakness of legs, loss of motor coordination of hands, dysarthria, dysphagia, deafness, blurring of vision, blindness, spasticity, rigidity, insomnia, childish facial expression, coma. High case fatality rate.	Factor waste pollution. Mercury complex picked up by marine organisms, transferred to fish without harm, but were lethal to man. Occurred in Japan. Fungicide used to treat seed grains.	Crab, shellfish, marine invertebrates, and fish. Wheat, maize, tortillas, break, pork.	Urine, feces, blood, tissues, hair. Shellfish, fish, water, mud, and organs. Digest, distill, form dithizone, filter, spectro-photometry.	Avoid eating grains treated with mercury compounds. Avoid feeding mercury contaminated grains to animals which are used for human foods. Prevent industrial mercury waste pollution. Avoid eating fish from mercury-polluted water.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Itai Itai (Ouch Ouch Disease, Chronic Cadmium Poisoning) (75,143, 162,185)	Cadmium.	Toxic changes in proximal renal tubules, hypercalciuric.	Several months. Prolonged ingestion hypercalciuria (blood urine), extreme bone pain due to osteomalacia, lumbago, typical cries of pain, pain in back, shoulders, joints, waddling gait to inability to walk, fractures under strain, proteinuria and renal lesion, glycosuria, aminoaciduria.	Mining wastes deposited in rice paddies over many years. Middle-aged women deficient in calcium and with multiple pregnancies most susceptible.	Rice, soybeans.	Blood, urine, rice, soil. Urinalysis, ash, spectrophotometry.	Eat adequate protein diet. Avoid continued ingestion of foods grown in soil with high concentration of cadmium. Prevent mining waste pollution of agricultural land.
Yusho (Rice Oil Disease, PCB Poisoning) (169,194)	Poly-chlorinated biphenyls.	Attacks liver and skin. Affects newborn infants of poisoned mothers.	Several months. Dark brown pigmentation of nails, acne-like eruptions, increased eye discharge, visual disturbances, pigmentation of skin, lips, gingiva, swelling of upper eyelids, hyperemia of conjunctiva, enlargement and elevation of hair follicles, itching, increased sweating of palms, hyperkeratotic plaques on soles and palms, weakness. Recovery takes years.	Heat-transfer agent. Environmental pollution from transformer, condenser, copy paper, recycling paper plants.	Salad oil.	Blood, skin, fatty tissue, oil. Extraction, chromatography. SGOT, SGPT	Construct heat-exchange equipment to prevent contamination of food. Prevent industrial waste pollution of water.
Toxic Pneumonia (207)	Unknown (cooking oil ingredient)	Causes acute respiratory toxicity	Interstitial pneumonia fever, dry cough, headache, dyspnea, chest pain, vomiting, variable rash, pruritis, diarrhea, obstruction, marked progressive eosinophilia, convalescence protracted with marked myalgia.	Significate association with ingestion of vegetables dressed with raw oil; occurred in Spain.	Oil, a mixture of ripe seed oil, liquified pork fat, and low-quality olive oil.	Oil, x-ray patients, analysis for Toxins Gas chromatography, animal toxicity testing.	Purchase oil for salad dressing and cooking from reputable company. Ingredients on label.

DISEASE	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Soy Protein Extender Gastroenteritis (161)	Soy protein extender (defatted soy flakes--texturized vegetable protein.	Unknown	Immediate to 6 hours, usually 1 hours or less. Nausea, abdominal cramps, dizziness, diarrhea, headache, difficulty breathing, vomiting, facial flushing, metallic taste, itching, swelling of tongue, lips, or face.	Food additive.	Tuna fish and other salads		Increase time-temperature of heating extender during processing.
Selenium Poisoning (57,70, 121,217)	Selenoamino acids.		Dermatitis, fatigue, dizziness, nausea, vomiting, diarrhea, loss of hair, loss of nails, discoloration of skin, dental caries.	Selenium-acid soil;Plants absorb selenium. Beer containing selenic acid from impure sulphuric acid.	Home-grown food with high concentration of selenium. Monkey coconut ( <i>Lecythis ollitoria</i> ). Beer.	Blood, feces, urine, hair, food, soil. Wet digestion, fluorometry.	Avoid eating food known to contain high concentration of selenium. Peel vegetables. Mill grains. Discard water after cooking.
Gastrointestinal and Food Allergies (3,89, 154,230)	Allergens react with antibody and form histamine or histamine-like substances.	Usually protein, sometimes sugars or fats. Depends on quantity, duration during which food is eaten, and regularity with which eaten.	Usually 2 to 12 hours. Immediate: Instantly to < 4 hours. Delayed: few hours to day or two. Gastrointestinal: Nausea, vomiting, abdominal cramps, diarrhea, constipation, bloating, excessive gas, backache. Urticaria, angioedema, itching, aphthous stomatitis. Swelling of tissues, edema, hives, rash, eczema or dilation of blood vessels, spasm of smooth muscles, asthma, rhinitis may occur instead of gastrointestinal symptoms.	Allergens or Enzyme Deficiencies	Milk (protein constituents) and milk products, eggs (whites), cereals (wheat, buckwheat, corn, rice, rye, oats), fish and seafood, meat, nuts, spices, vegetables (celery, string beans, lima beans, tomatoes), fruits (oranges, strawberries, bananas, lemons, watermelons), preservatives.	Skin tests.	Avoid eating responsible food or reduce quantity eaten. Cooking may destroy allergen.

DISEASE *	ETIOLOGIC AGENT	NATURE OF POISON	INCUBATION (LATENT) PERIOD/ SIGNS AND SYMPTOMS	SOURCE, RESERVOIR, AND EPIDEMIOLOGY	FOODS INVOLVED	SPECIMENS/ LABORATORY	CONTROL MEASURES
Disaccharide Intolerance (59,195)	Lactose, sucrose, or isomaltose.	Congenital defect of enzyme deficiency of disaccharidases causes defects in absorption of dietary disaccharides. Sugars ferment in colon.	Bloating, frothy diarrhea, flatulence, abdominal pain.	High incidence in blacks and orientals.	Milk and other foods containing disaccharides.	Stool (after ingestion of test sugar). Blood. Biopsy (peroral). Presence of acid and reducing sugars in stools. Blood-sugar levels.	Avoid eating offending disaccharide. Withdrawal of milk from diet (lactose intolerance).
Favism	(See Plant Toxicants and Toxins, page 49 for detailed description.)						
Amine Poisoning (96)	Tyramine (aromatic amine).	Tyramine in cheese can be degraded to p-hydroxyphenylacetic acid by monoamine oxidase inhibitors in certain tranquilizers causing hypertensive attacks.	10 minutes to 2 hours. Palpitation, severe throbbing headache, hypertension, flushing, profuse perspiration, neck stiffness, photophobia, nausea, vomiting, prostration. Cerebrovascular accidents may occur. Duration 10 minutes to 6 hours.	Food-Drug Combinations Cheese, monoamine oxidase inhibiting drugs (Eutonyl, Niamid, Marplan, Nardil, Parnate, Marsalid, Catron, Monase).	Cheese, canned milk, pickled herring, alcohol, cream, broad beans, yeast extract.	Distillation, extraction, spectro-photometry, chromatography.	Persons taking monoamine oxidase inhibiting drugs should avoid eating cheese and other listed food. Withdraw drugs.
Radio-nuclide Poisoning (120)	Various radio-nuclides, such as:		Symptoms depend on dosage, time, and organ affected. Genetic effect: lethal mutants, other mutations, shorter life span. Somatic effect: radiation sickness, leukemia, tumors, physical ailments.	Radioactive Substances Fallout, reactor plant accidents, radioactive wastes, natural substances.	Green, leafy legumes, vegetables, milk, fish, shellfish, meat, cereals.	Tissue of affected organ, foods potentially involved.	Stop nuclear weapons testing, safe construction of reactor plants, monitor to evaluate hazard.

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	Strontium 89	β radiation. Half life 51 days.	Bone cancer and leukemia.	Atmosphere to soil or plant. Plant to cow to milk or milk products to man (bone).	Milk	Ion exchange.	Peel and wash produce.
	Strontium 90	β radiation. Half life 28 years.	Bone cancer and leukemia.	Atmosphere to soil or plant. Plant to cow to milk or milk products to man (bone).	Green, leafy vegetables, milk, and milk products.		Peel and wash produce. Ion exchange for liquid food. Remove bones from meat.
	Iodine 131	β, γ radiation. Half life 8.1 days.		Atmosphere to plant to cow to milk to man (thyroid).	Milk.		Convert milk to dairy product and store for several weeks - monitor.
	Cesium 137	β, γ radiation. Half life 30 years.		Atmosphere to soil or plant. Plant to cattle to milk, meat, or other animal product to man; or atmosphere to water to seed plants, plankton, sediment, and algae to crusta- ceans, shellfish, fish to man or to predatory fish to man (total body liver, spleen, muscle).	Green, leafy vegetables, milk, milk products, meat, shell- fish, fish.		Peel and wash produce.
	Phosphorus 32	β radiation. Half life 14.3 days.		Atmosphere to plant to cow to milk to man (bone).	Green, leafy vegetables.		Peel and wash produce. Store for several weeks - monitor.
	Barium 140	β, γ radiation. Half life 12.8 days. Sequestered by tissue.		Atmosphere to plant to cow to milk to man (bone).	Milk.		Convert milk to dairy product. Store for several weeks - monitor.
	Ruthenium 106			Waste water to water to sea- weed ( <i>Porphyra</i> <i>umbilifera</i> or <i>catenata</i> ) to laver- bread to man (lower large intestine).	Laverbread.		Use seaweed from different sources. Eat different kind of bread.



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