Prevent Food Poisoning

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Prevent Food Poisoning

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Introduction

I'm going to travel in a foreign country and I've heard that travelers frequently get ill. What foods should I avoid?

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Is it safe to refreeze food that thawed when the freezer was accidentally disconnected?

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Is it safe to stuff a turkey the night before if refrigerated overnight? What about a commercially frozen turkey already stuffed?

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What is the safest way to process home-canned green beans?

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What kinds of foods can I safely hold in my automatic oven from 7 A.M. when I leave for work until 11 A.M. when the oven switches on? I have seen recommendations for roasting meat for 8 hours at 240° F. Under what conditions is this safe?

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Is it dangerous to put hot food in the refrigerator?

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What cooking methods should I avoid with dried eggs?

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How can we prevent several people from getting sick as they did last year at our family reunion picnic?

HOMEMAKERS FREQUENTLY ASK questions about food problems such as those in the adjoining column — those and many others. The questions all have one thing in common — their answers require some knowledge of bacteria. These and related questions are answered in detail in the section beginning on page 5.

This publication will help you to understand these microscopic forms of life — their nature and growth, and how they may cause food poisoning under certain conditions. It will also discuss ways of controlling their growth and preventing food poisoning.

If you are well informed on this subject, you can make safe and sound decisions in food buying, storage, handling, and preparation. The uninformed and the careless are often responsible for contaminating foods that cause food poisoning.

"An ounce of prevention is worth a pound of cure" certainly applies to food-borne illness. All persons who handle food must understand the methods of preventing contamination of food — whether in a restaurant or in their own kitchen.

Most foods are perishable and subject to spoilage and deterioration. Unless handled properly from harvest to the table, they can become contaminated with microorganisms that produce disease. You should be constantly alert for the dangers involved and know what measures to take to keep food wholesome.

To prevent foodborne illness, you must be aware of the roles of *time* and *temperature* — interrelated factors that influence the growth of micro-organisms. Like other living things — even like human beings — bacteria need *food*, *warmth*, and *moisture* to grow and increase. If any one of these three necessities is missing, bacteria will not grow. Disease-producing bacteria can grow at temperatures from 45° F. (the temperature in your refrigerator) to 140° F. The warmer it is the *faster* they grow. Bacteria that grow at temperatures higher than 140° F. are called "thermophilic." Those that grow at lower than 45° F. are called "psychrophilic." These both cause food spoilage. Learn more about these forms of life on the following pages.

Discover the Unseen World

IT IS ALMOST IMPOSSIBLE to comprehend the endless numbers and varieties of living things that you *could* see in each day of your life. Still, by far the greatest number and variety of living things are hidden from your eye without the aid of a microscope. One form of invisible life is called bacteria. These forms of life live in the soil, they inhabit fresh water and the oceans, they live on and within every larger form of life — and they are but one form of microscopic life. Other types are known as molds, rickettsiae, protozoans, and viruses.

Microbes are living things. They grow, eat, reproduce, and die. Some of them catch free rides into our life by way of dirt, food, water, and air — and that's where trouble can start.

Most microorganisms are not harmful to humans, animals, or plants. Bacteria do many useful things for us; for example, they help give flavor to cheese. Soil fertility, life in the oceans, and the food industry depend on the presence and activities of microorganisms.

- Souring of milk to produce yoghurt is practiced throughout the Balkan countries. The life processes of bacteria can change milk sugar (lactose) into lactic acid.
- Apple juice is fermented to vinegar. Cider is unfermented apple juice. The addition of a chemical, sodium benzoate, keeps it from fermenting to alcohol.
- Grape juice is fermented to wine.
- Sauerkraut is an excellent example of self-preservation by the production of acids by micro-organisms. Substances formed in the process contribute the characteristic flavor of sauerkraut.

Useful bacteria outnumber the harmful 5,000 to 1, and are benefactors to mankind; without them, no life could exist on earth. The harmful ones are agents of disease and death. Different diseases are caused by different bacteria with different likes and dislikes and different life habits.

So what is food poisoning? And how does it relate to bacteria? These two words — food poisoning — are a vague term which describe a group of illnesses traceable to food containing certain bacteria, or poisons which they produce; certain harmful chemicals; poisonous plants and even animals; or certain animal parasites. In this bulletin, we are primarily concerned with bacteria.

Four principal bacteria are involved. They have the forbidding names of:

1. Staphylococci
2. Salmonellae
3. Alpha-type streptococci
4. *Clostridium botulinum*
5. *Clostridium perfringens**

It might be easier to remember them by nicknames such as (1) Staph, (2) Sam, (3) Strep, and (4) Botch.

These produce two types of illness — food infection illnesses caused by eating food containing *living* organisms such as salmonellae, streptococci, shigellae, and others; and intoxications caused by eating foods in which certain organisms such as staphylococci or *Clostridium botulinum* have previously lived and produce a toxin or poison. The poison, not the microorganism, gives rise to intoxication illness.

Many other disease-causing organisms may occasionally, and more or less accidentally, cause food poisoning when transmitted in food. Included are those that cause typhoid fever, diphtheria, brucellosis, trichinosis, Weil's disease, infectious hepatitis, poliomyelitis, and other diseases.

"STAPH" FOOD POISONING

Staph food poisoning is the most common foodborne disease in the United States. Most adults have suffered attacks of nausea and vomiting caused by staph but no reliable statement of its prevalence can be made because (1) the illness may not be reported because it is mild or affects only one or a few persons; (2) it may be mistakenly attributed to other causes.

Staphylococci are extremely widespread in water, milk, and sewage. They are also present in the throat and nasal passages of many healthy persons. They occur on the skin, in pimples, skin lesions, and under fingernails. Food handlers may accidentally contaminate foods.

Mere consumption of staph cells will not cause food poisoning; however, illness results from consuming the toxin or poison produced by them. This toxin, called "enterotoxin" (entero means intestine) irritates the stomach and intestinal tract. It causes nausea and vomiting followed by abdominal cramps, severe diarrhea, and prostration. These symptoms may occur within minutes to 6 hours after consuming contaminated food. Fortunately, recovery occurs within 20 to 48 hours. The illness is seldom fatal. This toxin may not noticeably alter the appearance and flavor of food.

*See new material on page 11 in Addenda.

"SAM" FOOD POISONING

Salmonellae food poisoning (salmonellosis) has drastically increased in recent years. Several varieties may cause intestinal illness. The organisms live and grow in the intestinal tracts of animals and humans. The disease is transmitted by way of human and animal wastes, for example — when foodhandlers do not wash their hands well after visiting the restroom. The foods involved are often derived from infected animals or are contaminated during preparation or storage by infected animals or persons. Foods contaminated with salmonellae organisms have no abnormal odor or flavor. Meat from infected animals is condemned by government inspection at packing plants in the United States which sell meat in interstate commerce. Pasteurization, which kills salmonellae, sterilizes milk from infected cows.

Since some healthy animals may actually harbor salmonellae, uncooked animal products may be contaminated. The organism is transmitted not only in animal food products but also by certain other foods that come in contact with them. Salmonellae are probably present in small numbers under these circumstances and if food is properly refrigerated and cooked, no ill effects follow.

Food should be stored in places where mice, rats, cockroaches, and flies cannot get at it. These pests may carry salmonellae.

Flies feeding on human wastes from infected persons provide another sure path of contamination. Modern sewage disposal and fly control eliminate this route; and in areas with safe water supplies, the waterborne route becomes unimportant. These bacteria grow only in certain vulnerable foods.

Sickness usually occurs within 18 hours (12 to 24 hours is the range) after organisms are taken into the body. Diarrhea and abdominal cramps are the dominant symptoms, usually, accompanied by vomiting, chills, and fever.

Salmonellosis is milder than most forms of bacterial diarrhea. The illness usually runs its course in three days. Salmonellosis is rarely fatal except in elderly people and infants. The highest incidence and most severe forms are observed in infants under 1 year of age and in elderly persons.

BOTULISM

Botulism is the deadliest and the rarest kind of food poisoning. Inadequately preserved home-canned foods continue to present the greatest danger of botulism.

The U. S. Public Health Service assures that there is no reason to fear botulism from commercially processed foods, despite the widespread publicity and concern in 1963 when commercially processed food products resulted in nine deaths.

The food processing industry continues to have an excellent over-all safety record. Control is a matter of cooperation among bacteriologists, public health officials, and the entire food industry — from field to grocer's shelf. From this point on the responsibility lies with the homemaker and others handling food.

The botulinus organism lives on dead and decaying organic matter and is found almost everywhere in nature — in soil, dust, on fruits and vegetables, and other foods. In its dormant or resting phase as a spore it can survive for years.

Botulism is unique among the food poisons. Its toxin attacks the nervous system — not the gastrointestinal tract. Symptoms may appear a few hours or a few days after toxic food has been eaten. Botulism leads to muscle paralysis and death results from inability to breathe. It is fatal in approximately 65% of the cases in the United States. An ounce of pure botulinus toxin, according to some estimates, could kill millions of people.

Diagnosis of botulism is often difficult. Positive detection of botulism can be made only with a sample of the suspected food. An extract of the food is injected into white mice. The technicians must wait — sometimes many hours — to find out whether the extract is toxic. See page 10 for correct home-canning methods to prevent botulism.

"STREP" FOOD POISONING

Streptococcus is commonly found in the intestinal tracts of healthy humans and animals. Its symptoms are usually mild comparable to other types of food poisoning. They are characterized by nausea and sometimes by vomiting, colicky pains, and diarrhea. Symptoms begin within 5 to 18 hours after eating contaminated food. There is no specific treatment and recovery occurs naturally within 24 hours.

The foods involved are numerous and include dairy products, meats, poultry, and cream-filled bakery goods. Outbreaks occur where bacteria has time to grow because contaminated food was held at warm temperatures for several hours. Like salmonellae, these organisms produce no toxins.

The control of streptococcus food poisoning requires sanitary methods in handling foods and adequate refrigeration of perishable foods.

SUMMARY OF FOOD POISONING CAUSES AND CONTROLS *

FOOD POISONING	HIGH RISK FOODS	CONDITIONS FAVORING GROWTH	CONTROL
STAPHYLOCOCCUS	Foods rich in carbohydrates: • Custards and custard-filled baked goods such as doughnuts and pies. • Creamed fillings (eclairs and cream puffs) Protein foods: • Cooked meat products including cured meat, hams, precooked hams, leftover chicken and turkey which was improperly refrigerated, and meat, chicken, and fish salad, or sandwich mixtures. Dairy products: • Milk, cream, creamed dishes • Cheese • Ice cream if improperly handled • Other milk products	Holding foods for longer than 3 to 4 hours at temperatures between 40° F. to 140° F. These are internal temperatures of food, not the surrounding air. Leaving frozen foods and those ready for freezing at room temperature.	Refrigerate food at 40° or below. The toxin withstands heating and is resistant to boiling. Though the bacteria are easily killed by heat, the poison remains.
SALMONELLA	Uncooked and undercooked foods Improperly refrigerated prepared foods Foods prepared and contaminated by food handlers Animal food products — especially poultry and hogs (sausage): • Undercooked frozen meat and poultry pies • Undercooked meat mixtures • Raw sea food Food products containing eggs: • Meringue, baked Alaska, if underbaked • Custard-filled baked products, if not refrigerated • Raw and undercooked eggs, eggnog • Powdered eggs, broken egg products, frozen eggs • Uncooked batter from packaged mixes	Dangerous temperatures range from 40° F. to 140° F.	Cook all meat, fish, poultry, and eggs thoroughly. Do not hold foods below 140° F. (This is preferred serving temperature.) The higher the temperature the faster the bacteria are destroyed. Store foods where mice and pets can't get at them.
STREPTOCOCCUS	Dairy products Meats, poultry Creamed filled bakery goods Poultry dressings	Organisms grow at 55° F. to 115° F. and show high degree of salt tolerance.	Sanitary methods Adequate heating followed by refrigeration is necessary to destroy the organism. Pasteurizing will destroy a high percentage of streptococci.
BOTULISM	Underprocessed home canned low acid vegetables and meats: • Especially string beans; corn, spinach, chili peppers, beets, mushrooms, figs, meat, poultry, fish, home smoked fish, uncooked and improperly processed sausage and ham. Improperly processed or packaged commercial foods. Discard without tasting foods in bulging and swollen containers.	Poison is produced in the absence of oxygen (anaerobic conditions) such as an airtight container.	Process low acid vegetables and meats and other nonacid foods only by pressure cooker. See page 10. Refrigerate leftovers quickly to prevent germination and growth of bacteria.

*See page 13 for discussion of *Clostridium perfringens*.

Handle and Store Food Safely

This question and answer section is designed to answer some of the many questions on food safety.

Questions:	Answers:
1. Does freezing kill bacteria?	No. Freezing does not destroy all the organisms present in a food. But it keeps them from multiplying; and provided the food does not thaw, the number of organisms in it will grow only slightly with time.
2. My freezer was accidentally disconnected. Is it safe to refreeze the food?	It is impossible to judge the safety of thawed foods unless you know approximately how long each food has been thawed. Try to estimate how long the freezer was off and how long frozen foods have been thawed. If the food still contains some ice crystals, it may safely be refrozen. **Fruits** — You can refreeze thawed fruits without danger if they still taste and smell good, although the flavor and quality will not be as good. Fruits usually ferment when they start to spoil. A little fermentation will not make fruits dangerous to eat but may spoil their flavor. **Meat and Poultry** — Meat and poultry become unsafe to eat when they start to spoil. If packages of meat and poultry still contain some ice crystals, they may safely be refrozen. If the odor of thawed food is bad or questionable, throw the food away — it may be dangerous! **Vegetables, Shellfish, and Cooked Foods** — You can't tell by the odor whether vegetables, shellfish, and cooked foods have spoiled. Bacteria multiply rapidly in these foods even at 50° F. Do not refreeze any of these foods if they have thawed completely. If ice crystals are still in the food, it is safe to refreeze it immediately although the quality may suffer. If the condition of the food is poor or questionable, get rid of it. It may be dangerous!
3. I just discovered a frozen half turkey in my freezer which has been frozen for about 1 year. Is it safe to cook?	Maximum storage times for home frozen uncooked turkey that has been wrapped, frozen, and stored under the most favorable conditions is 6 months for turkey and 3 months for giblets. A turkey held frozen for 1 year would *probably* still be safe to eat but quality would be lost. Keep an up-to-date list of frozen foods near the freezer. List each food as you put it in the freezer, the form in which it was frozen, date of freezing, and the number of packages. Check each package off as you take it out. Check this from time to time so you will use frozen foods before they begin to lose quality.
4. What is the coldest section of most refrigerators? The warmest?	In most refrigerators set for normal operation the average temperature in the general storage area is between 38 and 42° F. The chill tray just below the freezing unit is the coldest area outside the freezing unit. The area at the bottom of the cabinet is the warmest. As air in the refrigerator circulates, the cooler air falls and forces the warmer air near the bottom to rise. The movement of air tends to dry out any uncovered or unwrapped food. Temperatures in the refrigerator-freezer combinations are about the same throughout the refrigerator sections.

Questions:	Answers:
5. Is it true that foods will sour unless cooled to room temperature after cooking before they are placed in the refrigerator?	No! This is not true. Souring is caused by spoilage organisms which survive the cooking process or are picked up by contamination. They grow in food when it is held at temperatures favorable to the organisms. These temperatures occur when foods are not refrigerated promptly. Prompt refrigeration will prevent souring, not cause it.
6. Why do authorities recommend covering raw meat, poultry, and fish lightly during refrigerated storage?	These meat products benefit from some circulation of air in the refrigerator. Because microorganisms need moisture and nutrients, they are inhibited by any film or membrane that keeps these things away from them. Thus the unbroken skin of a meat product, a dried surface, or a layer of fat reduces the rate and extent of bacterial growth.
7. Should the tight, transparent film on fresh, unfrozen meat and poultry be removed before storing these foods in the refrigerator?	Yes. A tight wrap will hold a moist atmosphere which encourages growth of microorganisms and development of unappetizing flavors and odors. Remove both film and paperboard tray. Place meat on a plate, and cover loosely with waxed paper or foil.
8. Why are ground meats more likely to spoil than roasts, chops, and steaks?	Because the meat surface has already been exposed to contamination from air, from handlers, and from mechanical equipment. Uncut meat keeps longer than cut meat. The growth of bacteria in ground meat is rapid and can reach very high counts. Fat in ground meat also enhances growth of bacteria.
9. How long can you keep ham in the refrigerator?	Ham keeps very well in the refrigerator. For maximum quality, store no longer than one week.
10. I accidentally left a cooked roast out of the refrigerator from 1 p.m. on Sunday until 8 a.m. on Monday. Is it safe to eat?	Meat should not be left at kitchen temperatures for over two hours if one is to prevent possible spoilage. Staphylococcus organisms may be found in some meats and other foods. No one can predict the incidence but if food so contaminated is kept at 60 to 110° F. for over four hours, a harmful toxin may be produced which is not destroyed by normal cooking temperatures.
11. How long can cooked meat be held in the refrigerator?	For maximum eating enjoyment, it should be served within four days.
12. What is the safest fast method for cooling meat in broth, or gravy?	Meat in broth or gravy should be cooled separately. Hot broth should be put into a bowl or wide-mouthed jar to hasten cooling. One-quart quantities cool quicker than larger amounts. A kettle of broth may be set into a pan of running cold water to cool rapidly before refrigeration. Stir the broth to prevent formation of a top coating of fat which may seal in the heat. Leave both the meat and the broth uncovered until cooled. Then cover if desired. Spread pieces of meat in a flat pan to cool more quickly. Don't stack hot cooked chicken or other meat to retard cooling. Large roasts may be cut in two to cool quicker. Remove the stuffing from a turkey and cool both separately. An unstuffed turkey cools as quickly as turkey meat removed from the bones. Do not cover cooked meat until cool. A covered dish, foil, or other wrapping retards cooling.

Questions:	Answers:
13. How long should meats be cooled before refrigerating? I have heard it is dangerous to put hot meat in the refrigerator.	Most meats can be placed in the refrigerator immediately after cooking or may be left at room temperature for two hours and then put into the refrigerator for further cooling. The rate of cooling for the first two hours is about the same — whether hot meat placed directly in refrigerator or left at room temperature for two hours and then refrigerated. Large roasts, stuffed turkeys, and meats in broth and gravy take so long to cool either at room temperature or in the refrigerator that some danger of spoilage is involved.
14. If meats and cheeses get moldy in the refrigerator, are they still safe to eat after the mold has been removed?	Summer sausage, salami, smoked ham, bacon, and other prepared meats, as well as cured cheeses, may occasionally become spotted with mold in the refrigerator. These foods are all safe to eat after the mold has been scraped or wiped off. If the mold is removed completely (some women like to finish by wiping the surface with a cloth moistened with vinegar), there should be little, if any, change in flavor other than that coming from several days of storage. Throw away fresh meat that has become moldy. It may or may not be safe to eat, and it's not worth the risk. Fresh meat is slow to develop mold; and while the mold itself is harmless, there may have been too great an opportunity for harmful bacteria to grow. Handle frankfurters the same as fresh meat.
15. Some manufacturers are promoting new cooking equipment featuring "programmed" or "automatic cooking." Are these new systems safe for handling foods?	They seem to be quite safe for handling foods, including meats. In fact, they are more desirable than the old method of placing food in the oven for some time before the heat comes on. "Programmed" or "automatic cooking" follows three steps: 1. Cooking starts at 325° F. 2. Temperature drops gradually to finish cooking. 3. Temperature drops again to hold the meat warm. A roast is sterile on the inside. The initial cooking in a 325° F. oven serves to make the cut surface safe also. Holding temperatures (140° F. and higher) are high enough to prevent any growth of undesirable organisms on the surface. Proper precautions are given in the instructions for handling casseroles.
16. What foods can safely be placed in an automatic oven at 7 a.m. with automatic controls set to switch on at 11 a.m.?	This is a dangerous practice. Four hours at room temperature (or temperature of unset oven) provides ideal conditions for the growth of bacteria. If meat placed in the oven is frozen or thoroughly chilled, the danger period is shortened since the frozen food requires time to thaw thus shortening the period of time when bacteria might grow. Foods that should not be held for 4 hours at room temperature or in a preset oven include creamed dishes, fish, ground meat and eggs.
17. I am preparing a holiday dinner for a large number of friends and relatives tomorrow. Is it safe for me to stuff the turkey tonight?	Do not stuff poultry and then refrigerate it before roasting. Studies have shown that if a stuffed bird is taken from the refrigerator and put into the oven the center of the stuffing may not reach the desired temperature by the time the meat is done. This is particularly true of large turkeys.

Questions:	Answers:
18. Why should commercially frozen stuffed turkeys be baked from the frozen state?	Poultry ranks high as a source of food poisoning largely because of contaminated stuffing or sauce. That is why instructions for baking frozen stuffed oven-ready birds warn against defrosting before roasting. The stuffing may become so contaminated that the allowable cooking time is not long enough to raise the stuffing temperature high enough to kill all the disease-producing bacteria. That also is why safe procedure calls for stuffing your turkey, defrosted or fresh, *just before* roasting. A meat thermometer inserted to measure stuffing temperature should show at least 165 degrees before removing from the oven. If you don't use a meat thermometer, see to it that your turkey is well done. This is not a meat to undercook.
19. I have been processing my home-canned green beans in a water bath and still haven't experienced any spoilage and my mother used this method all her life. Is this really a dangerous practice?	Outdated practices such as oven canning and the hot water bath method of processing low acid vegetables and meat, poultry and fish (including soups, stews, sauces, and mixtures containing these foods) are dangerous because they do not destroy the bacterial spores, and toxin accumulates as the organism grows during storage. In addition, oven canning may result in dangerous explosions.
20. New United States Department of Agriculture recommendations call for processing pickles. Why were these new recommendations adopted?	They are based on recent scientific studies. In one study, recommended processing methods produced "lethality scores" (measures of a method's ability to kill organisms) that were higher in all cases than those considered necessary to make a product safe. Also, the acidity of the processed pickles in the study was lower than the level at which *Clostridium botulinum* grows and produces toxin. After storage up to 6 months, processed fermented dill pickles were superior in color and texture to the unprocessed. Color and texture did not appear to be greatly influenced by processing. During the first 6 months of storage, the processed pickles were generally superior in flavor to the unprocessed. After 9 months of storage there was little flavor difference between processed and unprocessed pickles.
21. What dangers are involved in using cracked or broken eggs?	Salmonellae organisms may be present. A cooking temperature of 160° F. is needed to kill salmonellae. Not all parts of soft cooked, scrambled, or even fried eggs reach 160° F. Unbaked batters and doughs containing dried egg products may also be hazardous. Don't let children taste these. Baked products such as cakes reach this temperature. The Food and Drug Administration is proposing legislation which would require the pasteurization of all processed eggs.
22. Why are cracked eggs dangerous?	They may contain salmonellae from the laying hen, even a healthy hen. They get on the egg as it is laid. If the shell is broken, they go through the crack. The U. S. Public Health Service states that there is sufficient evidence to suggest that everyone avoid buying and using cracked or unclean eggs.
23. How can I prepare a safe, acceptable meringue?	Using the standard 2 tablespoons of sugar to an egg white, Michigan State University researchers found that it is safest to: 1. Put meringue on a warm or hot filling (though the warm filling is easiest to cover). 2. Cook the meringued pie at a low temperature for a long time (325° F. for 16 minutes or more) so that the meringue gets hot enough to destroy the bacteria.

Questions:	Answers:
24. At what temperatures are food poisoning organisms most likely to grow?	Food poisoning organisms and other pathogenic bacteria may grow over a rather wide range of temperature — from 42° F. to 126° F. In the Public Health Service Sanitation Manual, safe temperatures for potentially hazardous food have been defined as 45° F. or below and 140° F. and above. These temperatures apply to relatively short holding periods. Many bacteriologists would prefer to use 40° F. to 150° F.
25. What are preferred serving temperatures? Are these also safe temperatures for holding food?	Temperatures preferred by most individuals* are as follows: Soup ..... 145° to 150° F. Potatoes and vegetables ..... 140° to 145° F. Main dishes ..... 140° to 145° F. Beverages ..... 145° to 150° F. These are also safe temperatures for holding food, and gradually destroy food-poisoning bacteria. The higher the temperature, the faster the destruction.
26. Does freezing cause canned foods to spoil?	If freezing does not break the seal (or the seam, in the case of tin cans) the food will remain usable. Freezing may change the texture and curdle starchy products. Curdled products usually become normal after thawing and heating. Thaw frozen canned foods slowly.
27. Who is responsible for safeguarding public health in restaurants and grocery stores in Michigan?	The Food Inspection Division of the Michigan Department of Agriculture through its regulatory section and sanitarians of city and county departments of health enforce over 100 laws and regulations designed to protect the consumer and seller. These agencies inspect the sanitary conditions in all food handling establishments including: • restaurants • wholesale and retail grocery stores • frozen food locker plants • wholesale and retail bakeries • canning, freezing and preserving plants • slaughter houses • meat packing plants • sausage kitchens • soft drink bottling plants • grain elevators and flour mills • confectioneries and all other places where food intended for human consumption is prepared, stored, served, offered for sale or sold. When filthy or insanitary conditions are found in the operation of any food handling establishment, specific orders are issued to clean up and bring into compliance with at least minimum requirements. If the "Insanitary Notice" is not complied with within the specified period of time, legal action may be taken.

These figures are based on a study by G. G. Blaker in 1961.

Food Preservation Tips

CANNING

When you preserve food by canning, you are sterilizing it to destroy organisms that would otherwise spoil it by fermentation or decay. These organisms are bacteria, yeasts, and molds that are found anywhere — in air, soil, water, food, and on people. They grow and multiply least easily in extreme heat, cold, and dryness. They do not grow well in high concentrations of salt, vinegar, or sugar.

In the canning process, food is packed in containers. Heat kills the spoilage organisms. The containers are sealed to keep out other organisms and air. The heat drives out most of the air from the food and container, and the tight seal keeps it out. Any air left in may discolor the food at the top of the container. This is not dangerous — it just isn't attractive. (See the paragraph on oxidation in the "Freezing" section.)

Different foods require different sterilizing temperatures. Acid foods such as fruit, tomatoes, and pickled vegetables, can be safely processed at the boiling point. Organisms that spoil these foods usually have a low resistance to heat.

Low-acid foods — most vegetables, meat, and poultry — are hard to sterilize. They contain bacteria which form heat-resistant spores which will not be destroyed except by the high temperatures of the pressure canning process. Pre-heating (blanching) will reduce the number of organisms on these foods, but will not lower the temperature required to kill those that remain. This requires the higher temperatures.

Some organisms that live in the absence of air (called *anaerobic bacteria)* will grow and spoil food in sealed containers. One of them — *Clostridium botulinum* — produces an extremely potent poison in food. It can be present in food that shows no signs of spoilage.

In summary — there has not been much trouble with acid foods — fruits and tomatoes; but vegetables and meat — the low-acid foods — may spoil easily when processed without enough heat to kill the organisms in them.

PREVENT BOTULISM

1. Low acid vegetables (including all vegetables with the exception of tomatoes and pickled beets) should be processed in a pressure cooker with an accurate gauge. Higher temperatures provided by pressure cooking are needed to kill spores. Precise processing times for canning all non-acid vegetables and meats are listed in the United States Department of Agriculture Food Preservation bulletins:*

Home and Garden Bulletin No. 8 "Home Canning of Fruits and Vegetables" 1965

Home and Garden Bulletin No. 106 "Home Canning of Meats and Poultry" 1966

2. Use only fresh, firm fruits and vegetables. Wash, clean, and can as soon as possible after picking.

3. Never use or taste any food you suspect is spoiled (for example a bulging cap or lid; leaking can or jar; rancid or putrified odor; jar or can that foams or spurts on opening.)

Never taste any home-canned, low-acid vegetables and meat, poultry or fish processed by any method not involving a pressure canner. Boil suspected foods in liquid to cover for 15 minutes after opening and before tasting. A lesser time will not destroy possible poisons.

4. Outdated practices such as oven canning and the hot water bath method of processing low acid vegetables and meat, poultry, and fish do not destroy the spores and the toxin accumulates as the organism grows during storage. Don't use these dangerous methods.

FREEZING

Freezing foods and holding them at sub-zero temperatures slows down the changes which reduce food quality or cause spoilage. Like canned foods, frozen products can spoil by fermenting and decaying.

Freezing does not sterilize food. The number of organisms in and on the food must be reduced and kept at a minimum *before* the food is frozen. This means maintaining cleanliness on food and utensils, in the area where you prepare the food for freezing, and on the persons doing the work.

Oxidation is one chemical process that affects frozen foods. By oxidation, air reacts with the fruits and vegetables to change their color and flavor and reduce their content of certain vitamins. It can also cause fat foods to turn rancid. Oxidation causes the browning of some fruits during preparation for freezing. You can control this discoloration by adding lemon

* *Available from Supt. of Documents, U.S. Govt. Printing Office, Washington, D.C. 20402.*

juice to the food. The ascorbic acid in the juice reacts with the food to prevent the browning.

The best ways to stop or reduce oxidation are: (1) reduce in every possible way the amount of air left in the package, and (2) use packaging materials that let in little, if any, air after the package is sealed. Covering food with syrup, water, or gravy also helps keep air out.

Another cause of change in food is the action of enzymes. These substances exist in all plants and animals to promote growth and maturity. After harvest or slaughter, they also may improve or impair the quality of food products. Heat, cold, drying, and thorough smoking stop or slow down enzyme action, as do vinegar and other acids.

In acid foods, such as fruit, the acid itself and low temperature slow down the enzyme action enough to prevent change in the food. But low acid foods, such as vegetables, require brief heating (blanching) *before* freezing to slow down enzyme action and reduce the number of organisms.

Certain enzymes tenderize meat and poultry. This kind of action, which continues during frozen storage, has no bad effect on eating quality.

The best preparation and packaging will not be effective if the temperature in the freezer or compartment rises above 0° F. Even at 0°, certain changes can take place slowly in the eating quality or nutritive value of frozen foods. The rate of change goes up with the temperature. The higher the temperature and the longer the food is held at any temperature above 0°, the greater the loss of quality.

FOOD PRESERVATION INFORMATION

1. Home Freezing of Poultry, Home and Garden Bulletin No. 70, USDA, 1960
2. Home Freezing of Fruits and Vegetables, Home and Garden Bulletin No. 10, revised 1963, USDA
3. Freezing Meat and Fish in the Home, Home and Garden Bulletin No. 93, 1963, USDA
4. Home Care of Purchased Frozen Foods, Home and Garden Bulletin No. 69, USDA
5. Home Canning of Meat and Poultry, Home and Garden Bulletin No. 106, USDA, 1966
6. Home Canning of Fruits and Vegetables, Home and Garden Bulletin No. 8, USDA
7. What to Do When the Freezer Stops, Leaflet 321, USDA, 1963
8. Some Aspects of Food Preservation, Ball Brothers Co., Muncie, Indiana
9. The Science of Food Preservation, Ball Brothers Co., Muncie, Indiana.

References No. 1 through 7 are available from Superintendent of Documents, U S. Government Printing Office, Washington, D. C. 20402.

Addenda

(These addenda are a continuation of the discussion in column 2 of page 2.)

The illness caused by *Clostridium perfringens* does not fit either the food infection or intoxication category discussed on page 2. Researchers have discovered that extensive organism growth in the food and consumption of live organisms are necessary for sickness to occur but they have not found a free toxin or poison. Eating a food containing small numbers of *Clostridium perfringens* does not cause illness, suggesting that extensive growth does not occur within the intestinal tract.

CLOSTRIDIUM PERFRINGENS

In recent years this type of food poisoning has become one of the major causes of reported outbreaks. Like other food-borne diseases, it is difficult to determine the actual number of outbreaks because most go unreported.

Clostridium perfringens food poisoning has often been tagged a problem of the food service industry, since most outbreaks are associated with mass-feeding operations.

Foods most often involved in outbreaks of *C. perfringens* food poisoning are usually meat or poultry that have been cooked and held for some time before serving. Outbreaks more often occur after large banquets or at schools or hospitals where large amounts of meat, poultry and their gravies are prepared. However, this does not mean that *C. perfringens* food poisoning is limited to meals eaten away from home. It is highly possible to develop home kitchen conditions that will cause an outbreak — indeed this has happened many times.

Symptoms of the illness are abdominal cramps, diarrhea, occasionally nausea, and rarely fever or vomiting. The symptoms usually appear 4 to 22 hours after eating and may persist for 1 to 5 days. Mortality rate is extremely low.

Since the symptoms are relatively mild, the illness may go unreported or if the ill individual does consult a doctor, the illness may be diagnosed as "stomach flu" or a "virus" and disregarded or forgotten.

RECOMMENDED STORAGE PERIODS FOR FROZEN FOODS

*To Maintain Quality in Commercially Frozen Foods**

Food	Approximate holding period at 0° F.
Fruits and vegetables	
Fruits:	Months
Cherries	12
Peaches	12
Raspberries	12
Strawberries	12
Fruit juice concentrates:	
Apple	12
Grape	12
Orange	12
Vegetables:	
Asparagus	8
Beans	8
Cauliflower	10
Corn	10
Peas	8
Spinach	10
Baked goods	
Bread and yeast rolls:	
White bread	3
Cinnamon rolls	2
Plain rolls	3
Cakes:	
Angel	2
Chiffon	2
Chocolate layer	4
Fruit	12
Pound	6
Yellow	6
Danish pastry	3
Doughnuts:	
Cake type	3
Yeast raised	3
Pies (unbaked):	
Apple	8
Boysenberry	8
Cherry	8
Peach	8

Food	Approximate holding period at 0° F.
Meat	
Beef:	Months
Hamburger or chipped (thin) steaks	2-3
Roasts	8-12
Steaks	8-12
Lamb:	
Patties	3-4
Roasts	8-12
Pork, cured[1]	2
Bacon	less than 1
Ham	1-2
Pork, fresh:	
Roasts	4-8
Sausage	1-2
Veal:	
Cutlets, chops	3-4
Roasts	4-8
Ground meat	2-3
Cooked meat:	
Meat dinners	3
Meat pie	3
Swiss steak	3
Poultry	
Chicken:	
Cut-up	6
Livers	3
Whole	12
Duck, whole	6
Goose, whole	6
Turkey:	
Cut-up	6
Whole	6
Cooked chicken and turkey:	
Chicken or turkey dinners (sliced meat and gravy)	6

Food	Approximate holding period at 0° F.
(Poultry, continued)	
	Months
Chicken or turkey pies	12
Fried chicken	3
Fried chicken dinners	3
Fish and shellfish	
Fish:	
Fillets:	
Cod, flounder, haddock, halibut, pollack	4
Mullet, ocean perch, sea trout, striped bass	3
Pacific Ocean perch	2
Salmon steaks	2
Sea trout, dressed	3
Striped bass, dressed	3
Whiting, drawn	4
Shellfish:	
Clams, shucked	3
Crabmeat, King or Dungeness	2
Oysters, shucked	1
Shrimp	4
Cooked fish and shellfish:	
Fish with cheese sauce	3
Fish with lemon butter sauce	3
Fried fish dinner	3
Fried fish sticks, scallops, or shrimp	3
Shrimp creole	3
Tuna pie	3
Frozen desserts	
Ice cream	1
Sherbet	1

* *Quality foods frozen at home according to recommendations of the U. S. Department of Agriculture may be stored at 0° F. for approximately these same periods.*

[1] *Frozen cured meat loses quality quickly and should be used as soon as possible.*

FOOD SAFETY INFORMATION

BOOKS:

Food Poisoning, by G. M. Dack, University of Chicago Press, 1956.

Man Against Microbes, by Frederick Eberson, Ronald Press, New York, 1963.

Microbes and Men, by Harry J. Simon, Scholastic Book Services, Scholastic Magazine Inc., New York, 1963. National Science Teachers Assoc., 1201 Sixteenth St., N.W. Washington, D. C.

Practical Food Microbiology and Technology, by Harry H. Weiser, The Avi Publishing Co., Westport, Conn., 1962.

The Experimental Study of Foods, by Ruth Griswold, Houghton Mifflin Co., Boston, Mass., 1962.

Food Microbiology, W. C. Frazier, McGraw Hill Book Co., New York, New York.

GENERAL REFERENCES

Putting Food By, Ruth Hertzberg, Beatrice Vaughan, Janet Greene, The Stephen Green Press, Brattleboro, Vermont 05301 (Paperback), 1974, 4th printing. Provides factual information in an easy to read format. Includes canning, freezing, smoking, salting, drying, root-cellaring, soap making and other putting by practices.

USDA specialists have been working with this publication to improve its accuracy. It should be a useful reference for county home economists. It contains a variety of information that has not been brought together under one cover. Price $4.50 for soft cover.

LEAFLETS:

Calling All Consumers about Safeguarding Your Food, Misc. Publication 100, Foods and Standards Division, Michigan Department of Agriculture, 607 Lewis Cass Building, Lansing, 13, Michigan, July 1962.

Cold Facts About Home Food Protection,* U. S. Department of Health, Education, and Welfare, Public Health Service, 1964.

Some Aspects of Food Preservation, and The Science of Food Preservation, Ball Brothers Co., Muncie, Indiana.

You Can Prevent Foodborne Illness,* U. S. Department of Health, Education, and Welfare, Public Health Service, 1964.

Freezer Storage, CMI 87, Cupboard Storage, CMI 89, Refrigerator Storage, CMI 88, Inquire at county extension offices or write to MSU Bulletin Office, P.O. Box 231, East Lansing, Mi. 48824.

**For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.*

SUMMARY OF FOOD POISONING CAUSES AND CONTROLS

(Continued from page 4)

Addenda

FOOD POISONING	HIGH RISK FOODS	CONDITIONS FAVORING GROWTH	CONTROL
CLOSTRIDIUM PERFRINGENS	•Cooked leftover meat or poultry, mainly roast beef or poultry, usually turkey, dressing or gravy, chicken less frequently; gravies made from red meat, poultry and mushrooms. •Prepared dishes containing vegetables, or macaroni products usually with meat, poultry or fish.	Warm temperatures or room temperature. Grows best when there is no air or free oxygen (anaerobic conditions) present. Organisms can grow over a wide range from 60°F to 125°F. Grows best between 110°F and 117°F, temperatures quite frequently found in warm food storage areas. Heating of food, particularly liquids such as gravies or soups, drives out air and oxygen and creates an ideal environment for growth.	Correct handling practices. Refrigerate food below 45°F. Heat food and gravies and soups and sauces HOT before serving. Serve immediately. Keep hot food at 140 F or above. (Thorough cooking to hot temperature destroys vegetative cells but heat resistant spores can germinate and grow.)

ADDITIONAL REFERENCES ON SAFE FOOD HANDLING

FEDERAL BULLETINS

Order through Consumer Information, Public Documents Distribution Center, Pueblo, Colo. 81009.

Care of Purchased Frozen Foods; 1973; 6 pages; Publication No. 104B; 20c.

How the Consumer Can Report to the Food and Drug Administration; 1973; 4 pages; Publication No. 070B; free.

Keep Food Safe to Eat; 1972; 12 pages; Publication No. 111B; 10c.

Questions and Answers About Canned Foods; 1971; 2 pages; Publication No. 089B; free.

Storing Perishable Foods; 1971; 9 pages; Publication No. 116B; 20c.

What To Do When the Freezer Stops; 1972; 6 pages; Publication No. 117B; 20c.

Safe Food For Your Family; Cooperative Extension Service, Purdue University, Lafayette, Indiana; 15c.

BOOKS AND REFERENCE MANUALS

for teaching sanitation to food service workers.

Food Sanitation by Rufus K. Guthrie; 1972; AVI Publication Co., Westport, Conn.

Food Service Sanitation: Educational and Training Manual; National Sanitation Foundation, Ann Arbor, Mich. 48105; $2.50.

Sanitary Food Service: Instructor's Guide, 1969; Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; $1.50.

Sanitary Techniques in Food Service, by Karia Longree and Gertrude Blaker; 1971; John Wiley and Sons, Inc., New York, N.Y.; paperback.

FDA FACT SHEETS

In Michigan, order through Consumer Specialists, Food and Drug Administration, 1560 East Jefferson Ave., Detroit, Mich. 48207. Each fact sheet is a single page, available free but the supply is limited.

Clostridium Perfringens in Food
Salmonella
Shigella In Food
Staphylococci In Food

State Publications

Salmonellosis (EB339), 1967; Staphylococcus Food Poisoning (EB354), 1968; Clostridium Perfringens Food Poisoning (EB365), 1971; Botulism (EB372), 1972; Dr. Edmund A. Zottola, Extension Service, University of Minnesota, St. Paul, Minnesota 55101; 20c each.

Litho in U.S.A.