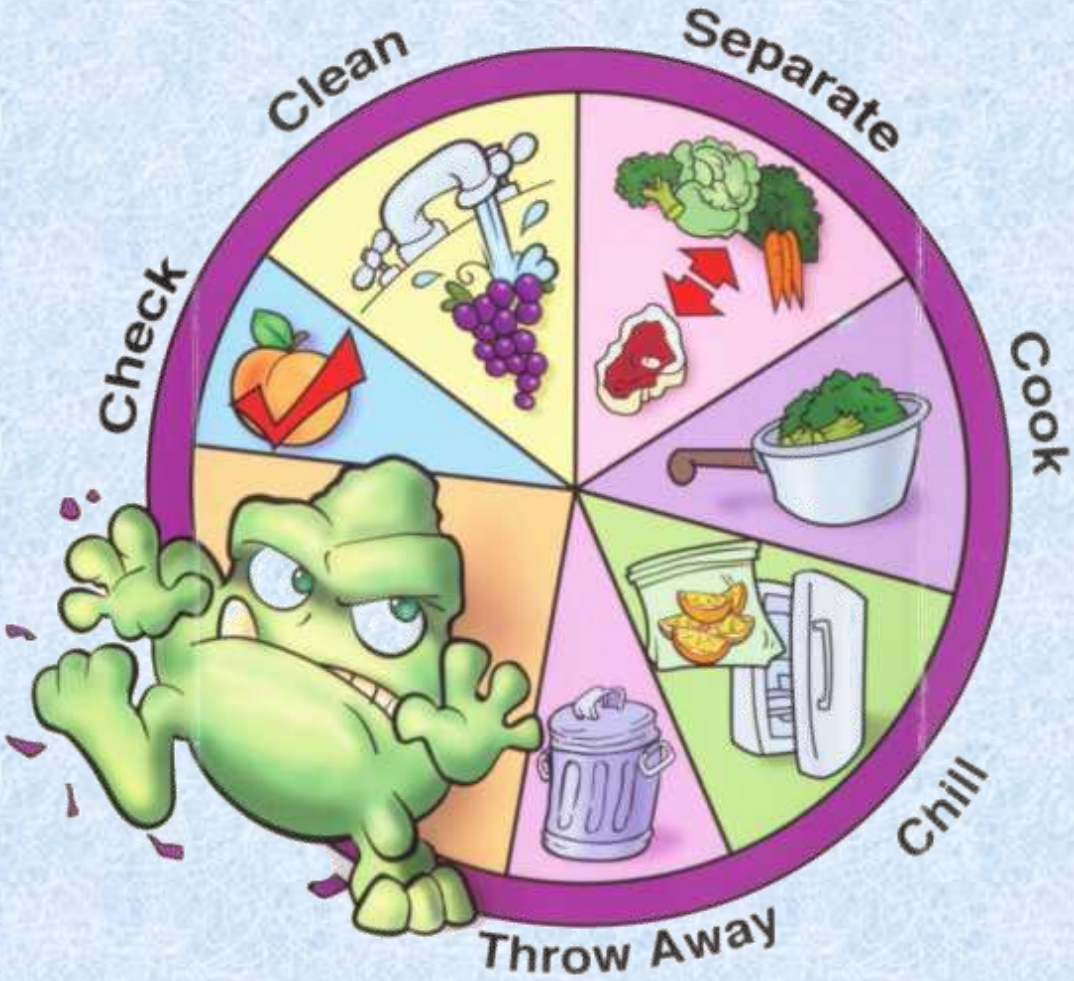
The Volgograd State Medical University
The Chair of hygiene and ecology

PREVENTIVE MEASURES AGAINST FOOD POISONINGS



What's Wrong?

I ate something bad, I have…..

Food Poisoning!

Types of Foodborne Illness

Infection

- eating food contaminated with pathogens, which then grow in the intestinal tract and cause illness

Intoxication

- eating food contaminated with the toxins (poisons) formed by bacteria
- eating food contaminated with other biological or chemical toxins (poisons)

Toxico infection

- eating food contaminated with pathogens (living microorganisms) that grow in the body and form toxins (poisons)

Food infections

- A foodborne illness is when a person eats food containing harmful microorganisms, which then grow in the intestinal tract and cause illness.
- Salmonellosis is a good example of foodborne infection.
- Zoonoses -Tuberculosis, brucellosis and helminthiasis
- Enteric infections - typhoid fever, dysentery, salmonellosis and some other

- Development of food borne illness results from the interaction of three factors: the pathogen, the host, and the environment in which they exist and interact.
- 1. The microorganisms or its toxin must be present in the food.
- 2. The food must be suitable for the organism's growth.
- 3. The temperature must be suitable for the organism's growth.
- 4. Sufficient time must be given for the organism's growth.
- 5. There must be enough of the microorganisms or their toxin present to cause illness.
- 6. You must eat the food.

- All bacteria need certain conditions to complete their life cycle
- prevention = controlling these conditions:
  - Food
  - Comfortable temperature
  - Moisture
  - The proper pH
  - The proper atmosphere
  - Time

pH

- Acid/Alkaline content of food is expressed on a scale of 0 to14
  - A pH of 7.0 is neutral
  - **Most bacteria prefer a pH of 6.6 to 7.5**
  - Bacterial growth is usually halted at a pH of 4.6 or less

Poor Personal Hygiene

Dirty Hands

Dirty Finger Nails

Dirty Uniforms

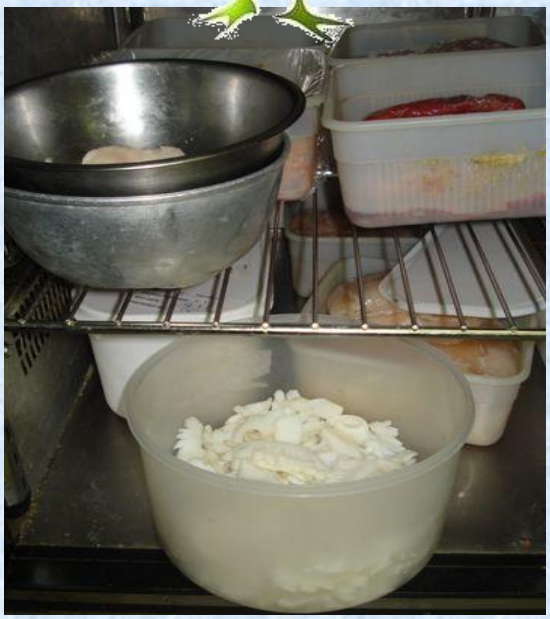
Smoking in Food Areas

Being Sick at Work

Open Cuts

Bad Food Storage

Food Not Covered



Dirty Kitchens

Fridge Not Cleaned

Dirty Stove Tops

Old Chopping Boards

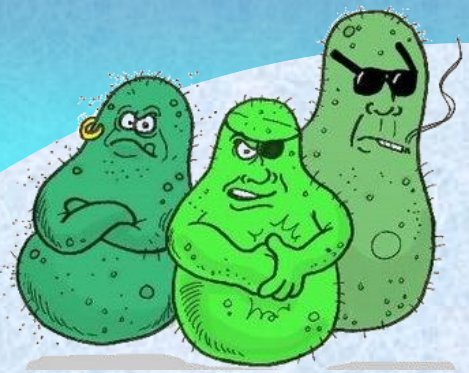
Food Has Past its Expiration Date

Mouldy Bread

Off Milk

Rotten Meat

Mouldy Cheese



Food Contamination

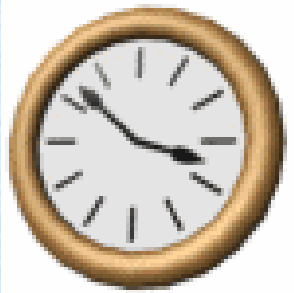
Mixing raw foods together

Cutting foods on chopping boards with raw meat juices

Under Cooked White Meat

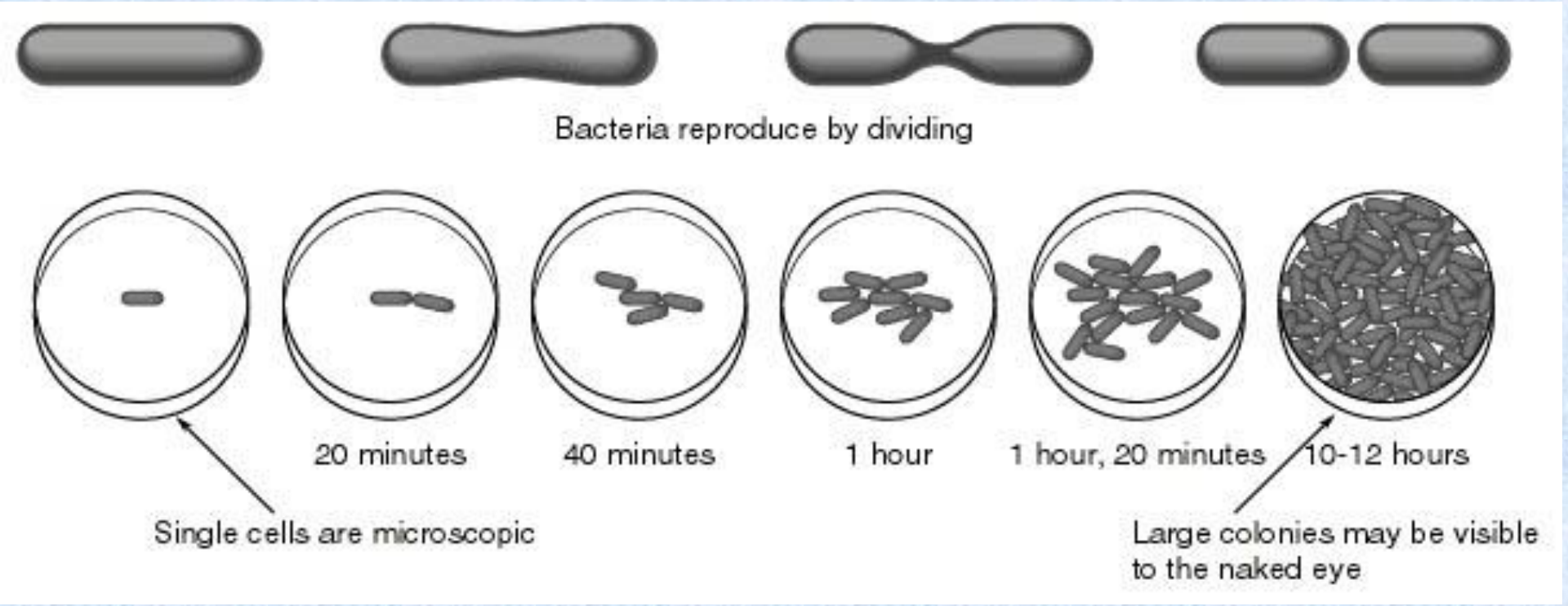
Refreezing Food

Leaving Food Out For a Long Period of Time

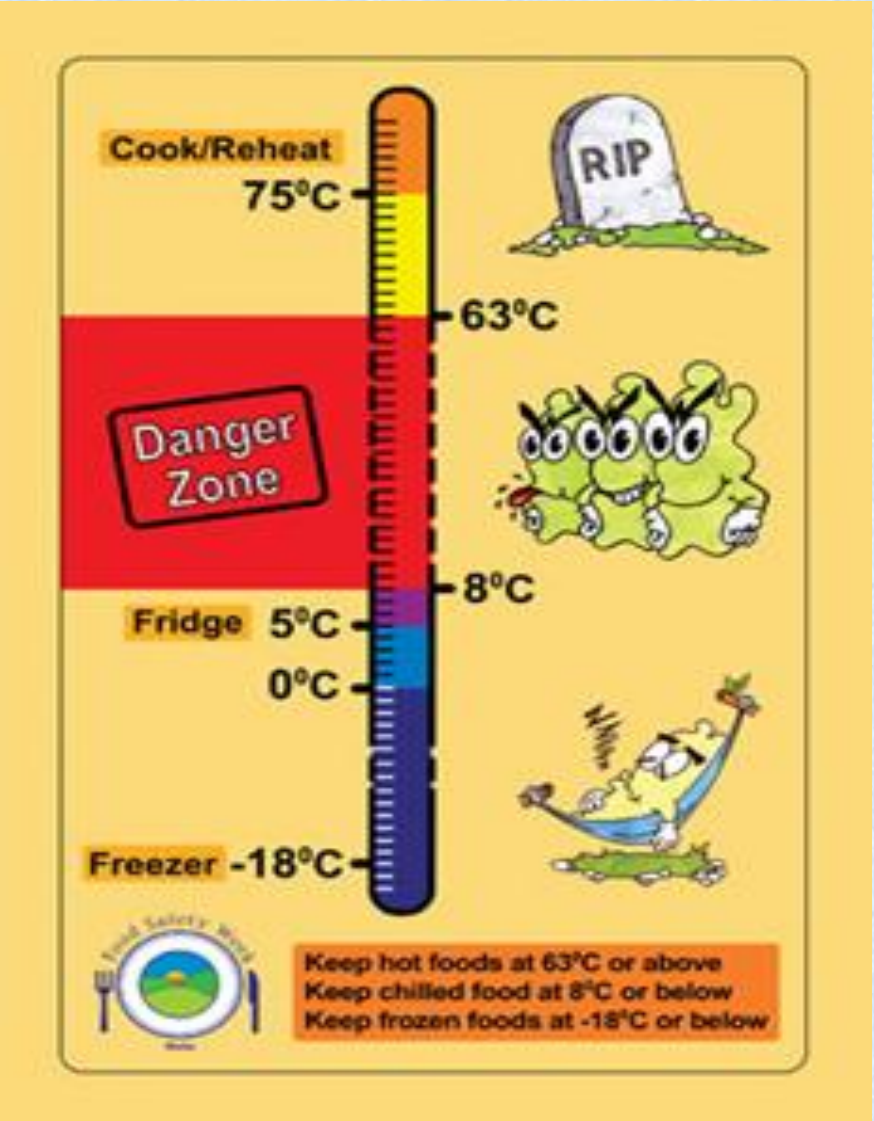


Once Frozen Food or Cooked Food has reached room temperature bacteria can start doubling after a few hours

Bacterial duplication



Incorrect Food Temperatures



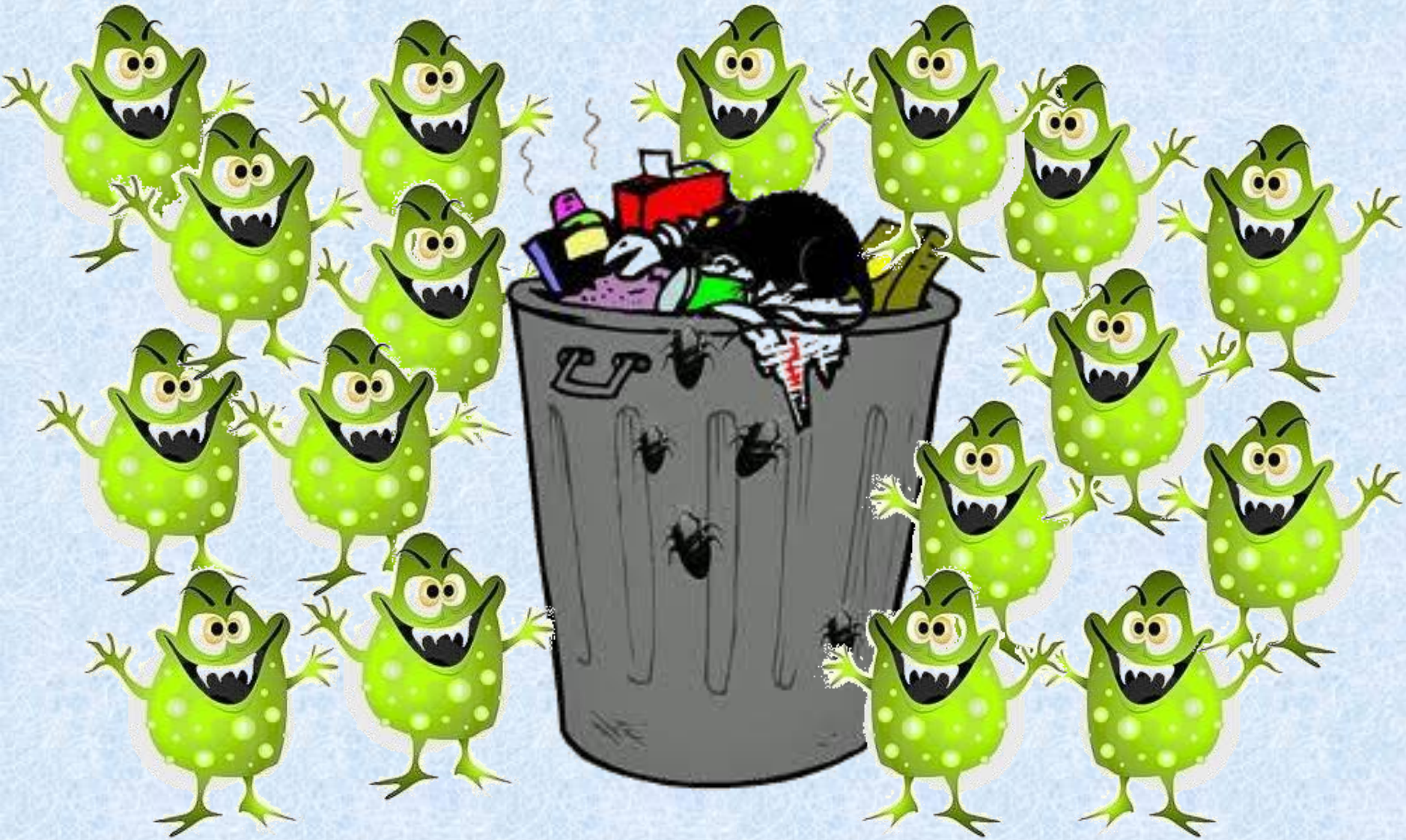
No Pest Control

Flies on the Food

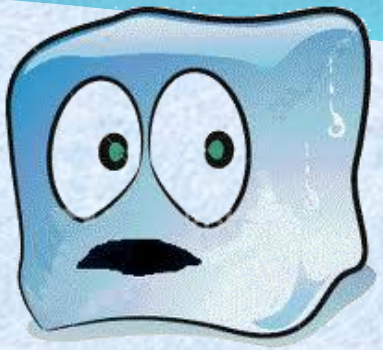
Cockroaches

Rats and Mice
In the Kitchen

Rubbish Bins not Emptied Regularly



Dirty Ice



Dirty Ice Machines

Using your hands

Leaving Ice on the Ground

How do you prevent Food Poisoning?

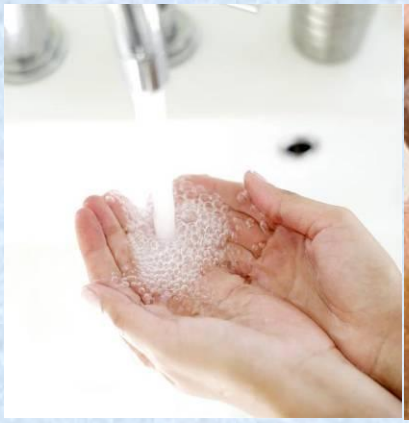
The main principles of preventing food poisonings of microbiotic origin:

- 1. Preventive measures against contamination of foods by harmful microorganisms. Isolation of the source of infection (patients and carriers should be revealed among workers).
- 2. Preventive measures against the spread of microorganisms in foods.
- 3. Preventive measures aimed at eliminating microorganisms found on the surface of foods.

1. Sanitary control over technical facilities and public catering (Keep Kitchen Clean)

1. Separate product lines for raw materials and cooked foods, Stop Food Contamination

1. Control over the health of food handlers (Good Personal Hygiene)



Wash your hands regularly

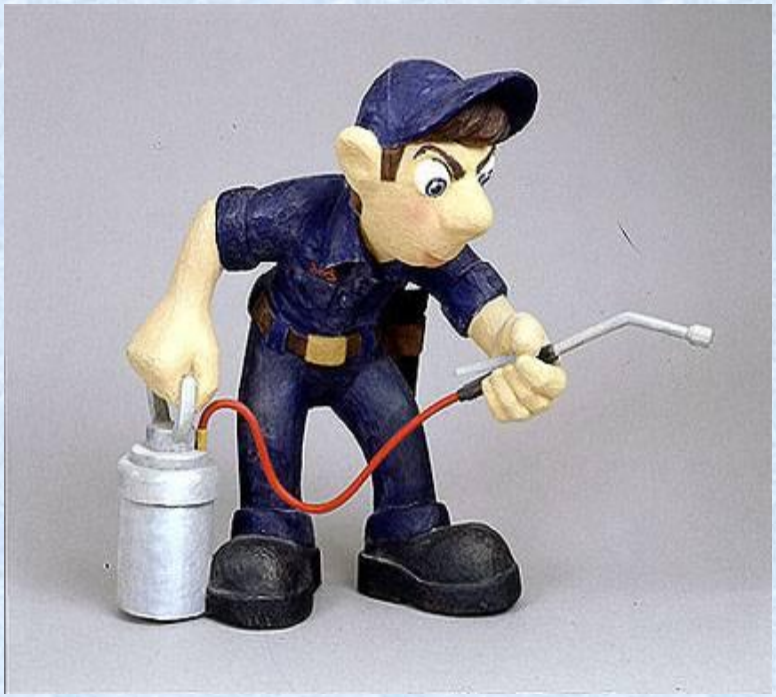
Especially after going to the bathroom

Have a Clean Uniform Available

If Sick Stay Home

Place a Band Aid on Cuts

1. Pest Control

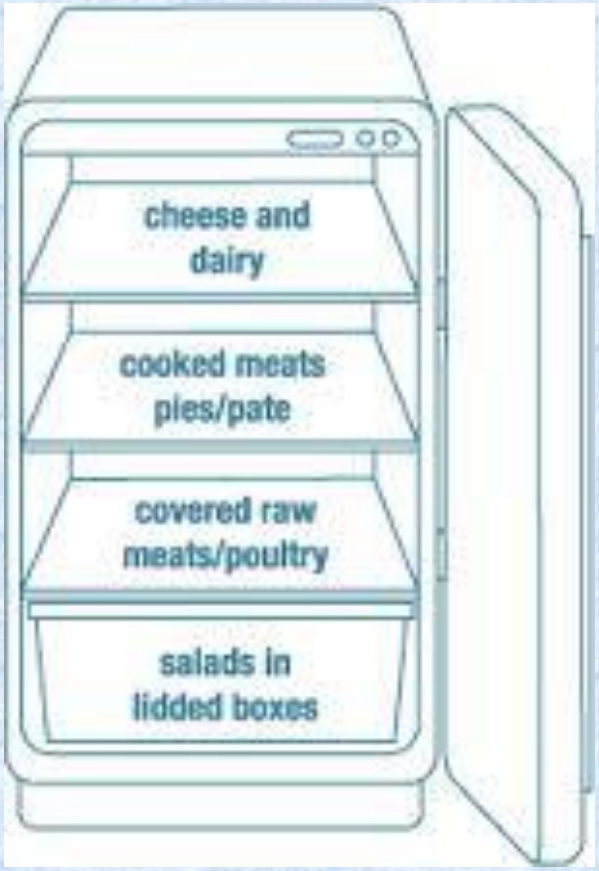


Pest Control should be done on a weekly basis

1. Take Care When Handling Ice

2. Correct Food Storage

Foods to be covered and stored separately



2. Check Expiry Dates and Label Foods

2. Observation of the sanitary rules of de-frosting. After a period of time Remove Frozen or Cooked Foods From Room Temperature

Frozen

Thawed (Always Thaw Foods in the Fridge)

Room Temperature

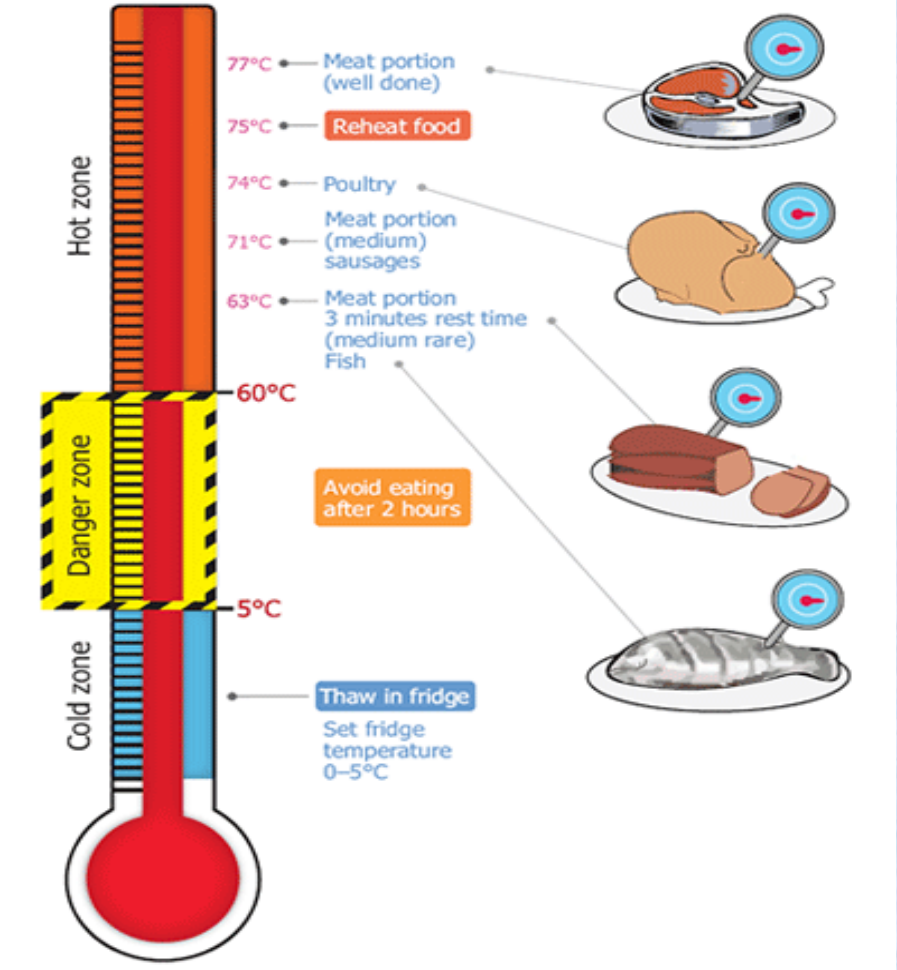
Cook

Eat

Or

Refrigerate

2. Use of cold at all stages of production and transportation of raw materials, convenience foods and cooked food is advisable



3. Thermal processing of food, check to see if the Meat is cooked

Food Thermometer

Salmonella

- Is aerobe microbe and viability in external environment. Boiling kills the salmonellas instantly. But salmonellas can keep their viability at freezing, for a long time. In a room dust they keep viability up to 80 days, in soil – up to 9 months, in water – up to 120 days, in milk – up to 5 days, in eggs – up to 13 months.

Salmonella

- The sources of Salmonella are domestic and wild animals as well as poultry. The waterfowl (e.g. ducks, geese) and eggs of the waterfowl are the most dangerous in this respect, too.

Two kinds of foods

Eggs

- in nature salmonella is found in the ground or stagnant water reservoirs, such as a pond or a lake where the ducks live. As a rule, ducks, geese and hens are infected with salmonella. Consequently, salmonella can
- be found in their eggs, too.

Meat

- especially cooked from minced meat (chops, meat-balls and others). The problem is that the meat of the cattle (beef, mutton, etc.) is often infected with salmonella (sick or bacteria carrier).

- The infection may **be congenital** as salmonella lives in the intestine of animals and under certain circumstances, for example, a sick animal, they can pass into blood vessels and then they are brought to the organs and tissues.
- The infection may occur as a **result of improper slaughtering**, **cutting the carcass**, **storage time**, **transportation and culinary processing of the raw foods**. Minced meat is the most dangerous source of infection as the degree of contamination with salmonella is higher when the meat is minced.
- Infected products usually have no any organoleptic changes (taste, smell, surface appearance).

Preventive measures against salmonellosis (via eggs)

- 1. The sale of duck and geese eggs should not be allowed. They should be used only under certain circumstances, for example, in confectionery manufacture.
- 2. **Do not eat raw or undercooked eggs**. Thoroughly wash eggs before cooking. Adequate thermal processing is needed if the person is threatened by an infection which is transmitted via eggs. The eggs should be boiled for 15 minutes to obtain hard-boiled eggs.

- Eggs can carry Salmonella bacteria both inside and outside the shell. Infection from contamination outside the shell is much less common today because egg producers follow strict procedures for cleaning and inspecting eggs. But another form of Salmonella infection can contaminate eggs before the shells are formed. Which part of an egg is infected: the white or yolk? It is yolk that is infected. It is due to a bactericide agent in the white, that is **lysozyme**, which destroys salmonella.

Be cautions with reptiles

- Such as turtles, lizards, and snakes, as they can carry the bacteria on the skin. Avoid contact with their feces. People who have reptiles as pets should wash their hands thoroughly after touching them. Small children should not have reptiles, especially turtles, as pets.

Preventive measures against salmonellosis (via meat)

- 1. Veterinary supervision over agricultural animals. Proper slaughtering and cutting the carcass (the intestine should not be damaged as salmonella lives in the intestine).
- 2. One should follow the rules of storage of meat, that is the temperature of storage, storage time, etc., transportation of meat. It should be transported by special vehicles intended for the transportation of meat.
- 3. One should follow the rules of culinary processing and, first of all, those of thermal processing. Proper cooking will kill Salmonella, so poultry and meat should be cooked to the proper temperature.

Classification of food poisonings

1. Food poisonings of microbiotic origin

- 1. **Food toxicoinfections**

  (*Proteus vulgaris*, *Proteus mirabilis*, *Clostridium perfringes*, *klebsiella*, *Esherihia coli*)

- 2. **Food intoxications:**

  - bacterial toxicoses

  (staphylococcal toxicosis and botulism)

  - mycotoxicoses

2. Food poisonings of non-microbiotic origin

- **1. Non-microbic poisonings caused by poisonous foods or by the foods which have become poisonous under certain circumstances**
- **2. Poisonings caused by chemical substances of anthropogenic origin. The notion of xenobiotics**
- **Poisonings caused by pesticides.**

Food toxicoinfections

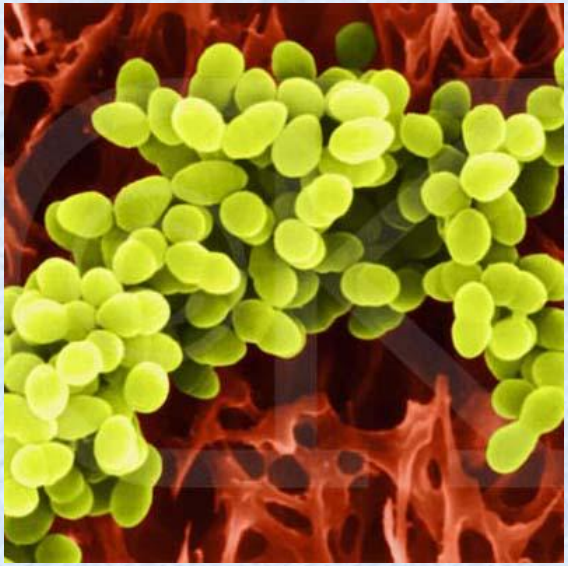
- occur upon the consumption of foods covered with great amounts of living microorganisms. While in the intestinal tract, the bacteria produce toxins that cause illness.

Food intoxications

- The term food intoxications refers to diseases which occur upon the consumption of foods containing exotoxin accumulated in the human body. The bacteria which produced and excreted the toxic waste products into the food may be killed, but the toxin they produced causes the illness or digestive upset to occur.
- Staphylococcus aureus and Clostridium botulinum are two species of bacteria that cause food poisoning.

Staphylococcal toxicosis

- often occurs after the consumption of foods containing golden staphylococcus enterotoxin (*Staph. aureus*). The toxin is extremely heat-stable, sometimes the bacteria will already be killed, but the toxin remains.



The most common sources of microorganisms

- Food workers who carry the bacteria
- People working on a farm who have a purulent staphylococcal infection (furunculosis, tonsillitis, septic wounds, etc.)
- Animals which suffer from mastitis, for example, cows, goats.

The most common foods

- **Protein-rich food**

milk and dairy products, for example, sour cream, cottage cheese, ice-creem, cheese and so on. Staphilococci are able to multiple in cooked meat and fish, poultry and egg products.

Preventive measures

- **1. One can prevent staphylococci from contaminating food by**

  - suspending workers in dietary departments who are suffering from pustules diseases, acute febrile catarrhal inflammation as well as carriers of staphylococcus.

  - observation of sanitary rules on a farm and in dietary departments

  - not using milk from cows with mastitis.

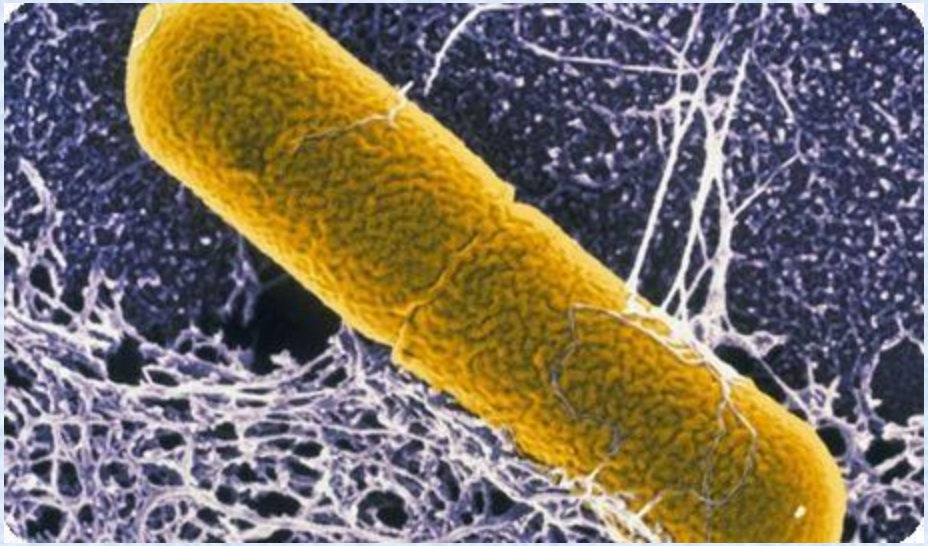
Preventive measures

- **2. To create favorable conditions of killing staphylococci:**

  - observation of the rules of cooking foods, storage time and shelf-life of cooked foods.

Botulism

- is a very severe food toxicosis. It usually develops upon the completion of an incubation period which lasts for 2 – 12 hours resulting from the consumption of foods containing *Clostridium botulinum* exotoxin accumulated in the human body.



Botulinum toxin

- is one of the most powerful biological poisons. It usually destroys after boiling for 10 minutes. It multiplies only in the conditions when there is no free oxygen. Therefore, the foods which are potentially dangerous in this respect are canned foods (vegetable, mushroom), home-made meat, smoked fish.

The symptoms of botulism

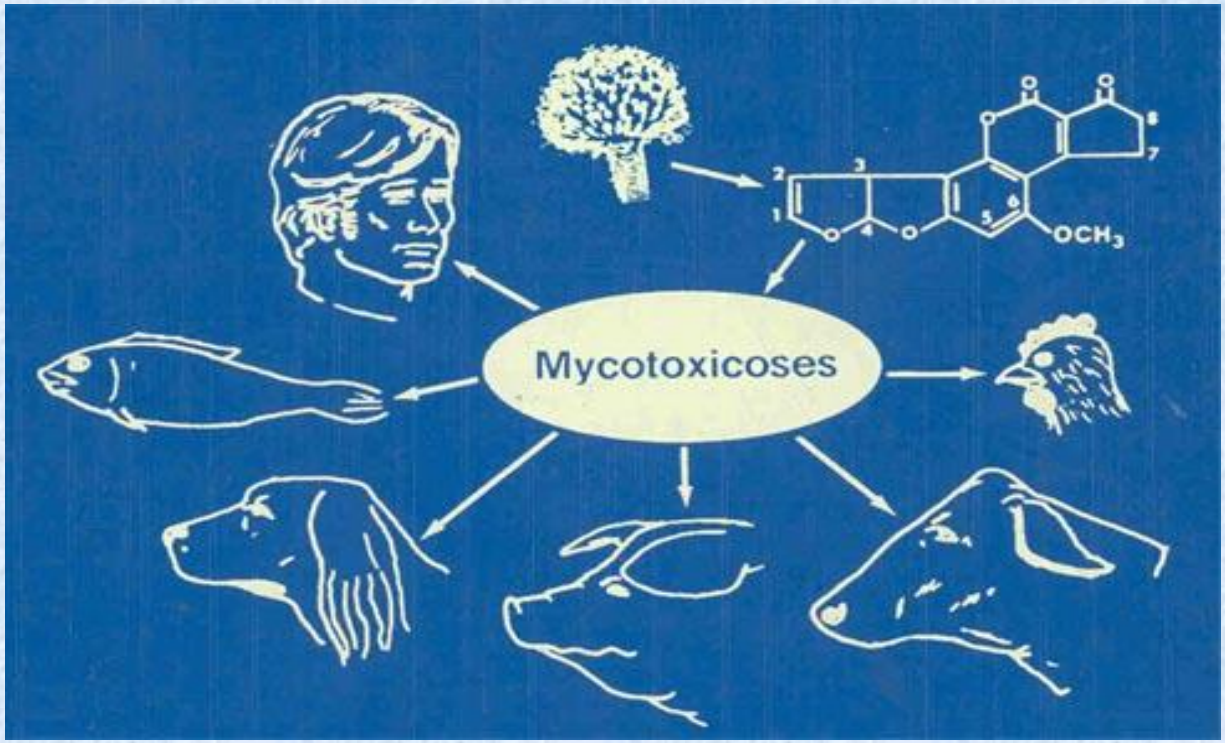
- Include double vision, blurred vision, dropping eyelids, slurred speech, difficulty swallowing, dry mouth, and muscle weakness. These are all symptoms of the muscle paralysis that is caused by the bacterial neurotoxin. If untreated, these symptoms may progress to cause paralysis in various parts of the body.

Preventive measures

- include sanitary and educational work among the population on the technology of making home preserves.

Food mycotoxicoses

- usually occur upon the consumption of processed grains and legumes, for example, corn, cereals, rice, peas, peanut which contain microscopic fungi.



Fungi genera	Associated mycotoxins
Aspergillus	Aflatoxins, ochratoxins, cyclopiazonic acid, patulin, sterigmatocystin, gliotoxin, citrinin
Penicillium	Ochratoxins, citrinin, patulin, penicillic acid, cyclopiazonic acid, penitrem A, griseofulvin, PR toxin
Fusarium	Fumonisins, moniliformin, zearalenone, zearalenol, deoxynivalenol, nivalenol, 15-acetyldeoxynivalenol, 3-acetyldeoxynivalenol, T-2 toxin, iso T-2 toxin, acetyl T-2 toxin, HT-2 toxin, T-2 triol, T-2 tetraol, fusarenon-X, diacetoxyscirpenol, scirpentriol, 15-acetoxyscirpentriol, neosolaniol, fusaric acid
Claviceps	Ergot alkaloids

Ergotism

- occurs upon the consumption of grains, for example, rye, wheat, containing microscopic *Claviceps purpurea* fungus.

Ergot alkaloids

- Ergot alkaloids have a wide range of biological activities including effects on
- circulation and neurotransmission
- vascular system due to vasoconstriction of blood vessels, sometimes leading to gangrene and loss of limbs due to severely restricted blood circulation. The neurotropic activities of the ergot alkaloids may also cause hallucinations and attendant irrational behavior, convulsion, and even death.

Fuzariotoxicoses

- occur upon the consumption of grains containing *Fuzarium* fungi. The disease usually occurs upon the consumption of bread made of flour containing toxins of the same fungus.

***Fusarium* ear rot of corn:**

A) infection through silks

B) infection through wounds (insect damage)

Pictures kindly provided by Dr. Marc Lemmens, IFA Tulln, Austria

Aflatoxicoses

- occur upon the consumption of foods containing *Aspergillus flavus* aflatoxins. Corn, peanut are the foods which contain great amounts of aflatoxins.

- High-level aflatoxin exposure produces an acute necrosis, cirrhosis, and carcinoma of the liver exhibited by hemorrhage, acute liver damage, edema. Chronic exposure also leads to a high risk of developing liver cancer.

Prevention and control of mycotoxins in stored grains and seeds

- 1. **Dry the grain**

  Fungi cannot grow (or mycotoxins be produced) in properly dried foods, so efficient drying of commodities and maintenance of the dry state is an effective control measure against fungal growth and mycotoxin production.

  To reduce or prevent production of most mycotoxins, drying should take place as soon after harvest and as rapidly as feasible. At times when sun drying is not possible or unreliable some form of mechanical drying may be necessary.

- **2. Avoid grain damage**

  Damaged grain is more prone to fungal invasion and therefore mycotoxin contamination. It is thus important to avoid damage before and during drying, and in storage. Insects are a major cause of damage. To avoid moisture and mold problems. Such problems are compounded if the grain lacks adequate ventilation, particularly if metal containers are used.

- **3. Ensure proper storage conditions**

  While keeping commodities dry during storage in tropical areas can be difficult, the importance of dry storage cannot be overemphasized. In tropical areas, outdoor humidity usually - 70% and more on sunny days.

  Ideally, all large-scale storage areas should be equipped with instruments for measuring humidity, so that air appropriate for ventilation can be selected.

Food poisonings of non-microbiotic origin

- **1. Non-microbic poisonings caused by poisonous foods or by the foods which have become poisonous under certain circumstances.**

  These food poisonings are caused by foods of both animal and plant origin.

Animal origin

- Liver and meat of poisonous sharks are the most common foods of animal origin which can cause food poisonings. Food poisonings can be caused by the mackerel, for example, tuna, jack mackerel, etc., as the improper storage time can cause the conversion of hystidine contained in meat of these fish in large amounts into a poisonous substance, zaurin.

Plant origin

- Henbane, belladonna, celandine and others are the most common foods of plant origin which can cause food poisonings.
- This group includes also poisonings caused by poisonous mushrooms, for example, pale toad-stool (*Amanita phalloides*).

Preventive measures

- against food poisonings include sanitary and educational work among the population (at schools, in nurseries, etc.).

2. Poisonings caused by chemical substances of antropogenic origin

- Foreign chemical substances, called xenobiotics, enter the human body from the contaminated natural environment through food webs.

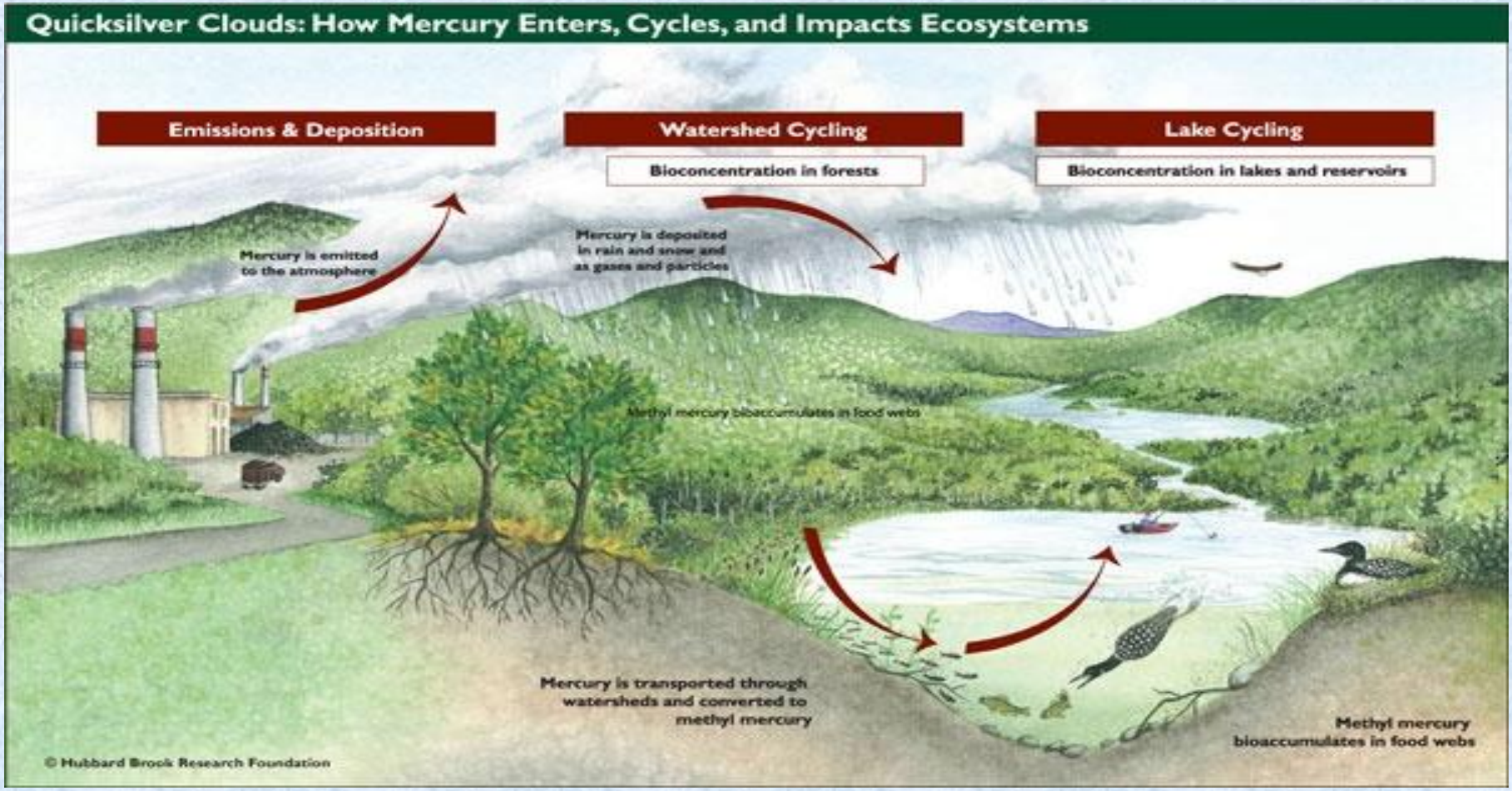
  It is established that 70 % of xenobiotics come with food, 20 % - from air, 10 % - with water.

Poisonings caused by pesticides.

- Pesticides are poisonous chemical substances used in agriculture for pest control.
- The range of effects of pesticides includes **teratogenic, embriotoxic, gonadotropic and cancerogenic effects.**

- Human pollution is a serious problem, especially near population centers where industrial wastes and human sewage flow into the water.

Heavy metals such as mercury can accumulate in larger fish (sharks and swordfish).



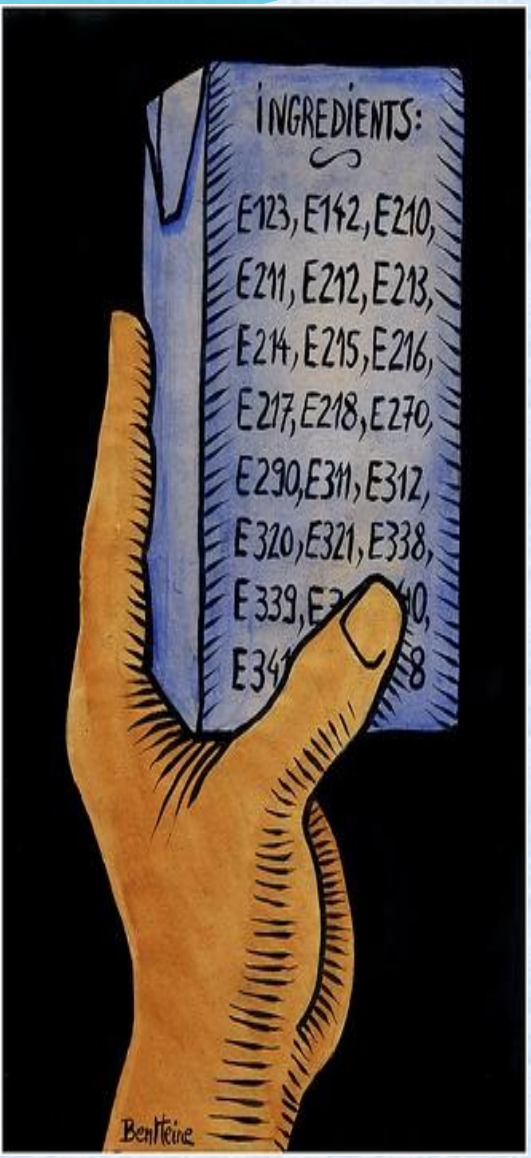
Poisonings caused by nitrates, nitrites, nitrosamines

- Chronic intake of great amounts of these substances can result in the formation of methemoglobin. It can result in the development of chronic alimentary nitrate-nitrite methemoglobinemia.

  Nitrites are widely used in preservation of meat as well as in manufacture of sausages for the improvement of flavour.

The problem of food additives.

- **Food additives** are natural compounds and chemical substances which are not used as foods themselves but are added to foods in small quantities to give the foods valuable properties, to increase the stability of foods under certain circumstances, to preserve their appearance (according to the WHO)
- In the EU countries codification with the letter "**E**" is used.
- For example, ascorbic acid which is often added to foods as an antioxidant is defined as **E300.**



- E100-E182 – dyes used for coloring of foods.
- E200, etc. – preservatives contributing to long storage time of foods.
- E300, etc. – antioxidants which slow down oxidation and prevent damage.
- E400, etc. – stabilizing agents preserving the consistency of foods.
- E500, etc. – emulsifying agents maintaining the structure of foods.
- E600, etc. – taste and smell intensifiers.
- E900, etc. – antifoam substances.
- E1000, etc. – sweeteners.

- • acids (e.g. citric acid, give a sour taste)
  • anti-caking agents (e.g. some phosphates, to help food flow easily)
  • bases (e.g. bicarbonate, as a raising agent and acid neutralizer)
  • bulking agents (e.g. guar gum, adds bulk without adding any calories)
  • firming agents (e.g aluminum salts, to retain crispness)
  • flavour modifiers (reduces flavour)
  • flour improvers (e.g. cysteine)
  • glazing agents (e.g. waxes, to give polished appearance)
  • humectants (e.g. glycerol, to prevent foods, such as marshmallow, drying out)

- • liquid freezants (e.g. liquid nitrogen, to freeze food quickly)
  • packaging gases (e.g. nitrogen, to control the atmosphere within a package)
  • propellants (e.g. carbon dioxide, to form an aerosol, forcing food out of containers)
  • release agents (e.g. silicates, to prevent food sticking to pans)
  • solvents (e.g. glycerol, to dissolve solids in food).

Aspartame

is an artificial sweetener that is at least 200 times sweeter than white sugar.

You can find it in:

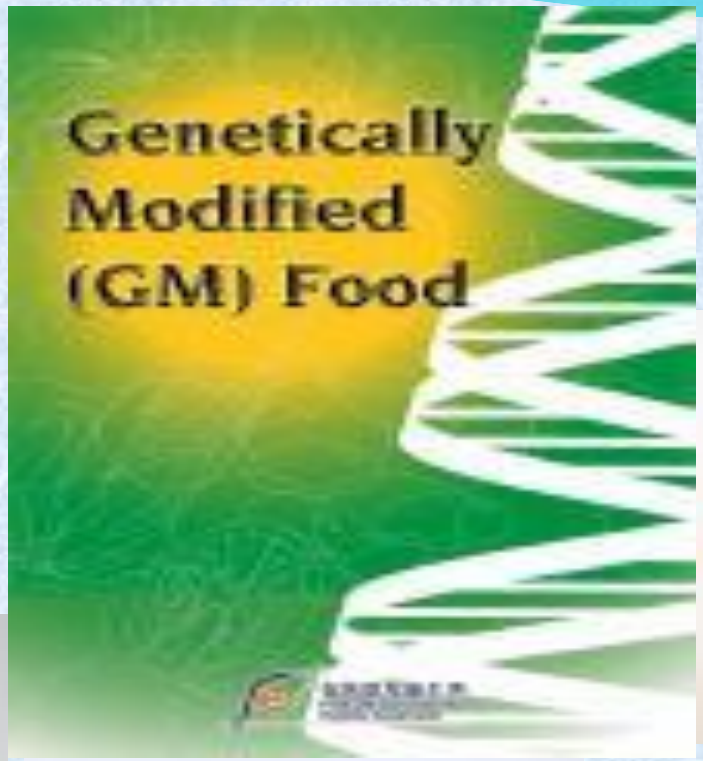
- Sugar-free beverages and soda
- Gum, Candy, Instant desserts,Instant breakfasts,
- Some breakfast cereals, Hot chocolate mixes
- Frozen desserts, Low-calorie desserts
- Yogurt, Laxatives, Gelatin
- Drink mixes, Breath mints
- Some brands of chewable vitamin supplements and children's multi-vitamins

Aspartame is made up of three main chemical components:

- **1. Phenylalanine** (40%) – Phenylalanine is an amino acid that is normally found in your brain. The problem with phenylalanine comes in when too much gets into your brain. Too much can cause the serotonin levels in your brain to go down. If your serotonin levels are too low, it can leave you feeling depressed.
- **2. Aspartic acid** (50%) – Aspartic acid is also an amino acid that also occurs naturally in foods such as avocados, asparagus, and oats. Too much can lead to a number of serious symptoms and problems including neurological problems.

- This flooding reaction does not happen when you eat foods that naturally contain phenylalanine and aspartic acid.
- Natural foods are made up of a wide variety of other amino acids and nutrients. They do not just contain phenylalanine and aspartic acid alone. The combination of nutrients in natural foods allows the amino acids to be metabolized in a way that your body can handle.
- Aspartame is **NOT** natural. Your body cannot metabolize it in a way that is healthy for you.

- **3. Methanol** (10%) – Methanol is also known as methyl alcohol or wood alcohol. **Methanol is poisonous!** Without a doubt, it is hazardous to your health.
- Aspartame is linked to a long list of side effects including:
- Headaches and/or migraine headaches, Nausea and diarrhea, Depression, Anxiety attacks , Rashes, Abdominal pain, Muscle spasms, Dizziness, Blurred vision and other visual disturbances such as bright flashes, pain, decreased night vision, and others
- Insomnia and other sleep disorders, Ringing in the ears, Inability to tolerate noise, Mood swings, Memory loss.


Genetically
Modified
(GM) Food

- Genetically-modified foods have the potential to solve many of the world's hunger and malnutrition problems, and to help protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides and herbicides. Yet there are many challenges ahead for governments, especially in the areas of safety testing, regulation, international policy and food labeling.

- Many people feel that genetic engineering is the inevitable wave of the future and that we cannot afford to ignore a technology that has such enormous potential benefits. However, we must proceed with caution to avoid causing unintended harm to human health and the environment as a result of our enthusiasm for this powerful technology.

Human health risks

- 1. Allergenicity

_There is a possibility that introducing a gene into a plant may create a new or cause an allergic reaction in susceptible individuals.

2. Unknown effects on human health

There is a growing concern that introducing foreign genes into food plants may have an unexpected and negative impact on human health.