Food Safety Hazards

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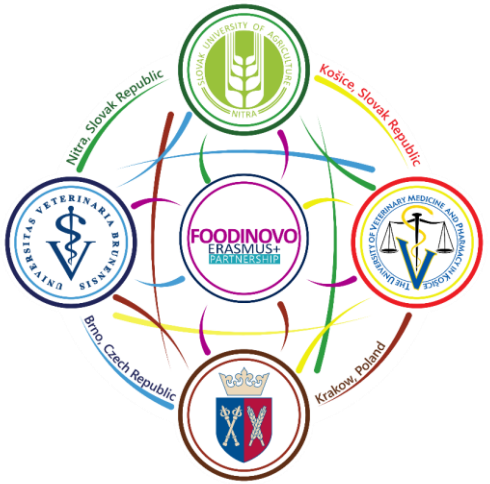
Introduction



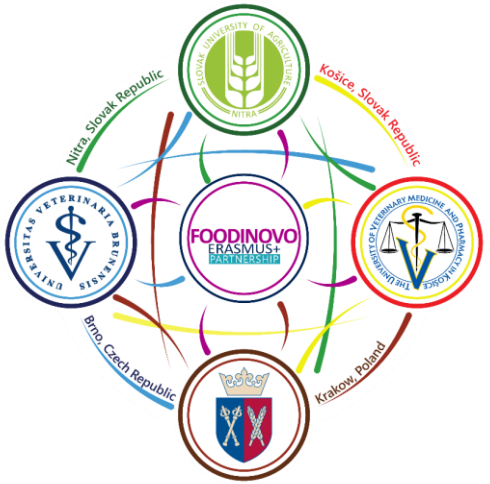
- Why is food safety in interest?
- Fundamental principle of EU food safety policy
- Integrated approach „from farm to table“

Why is food safety in interest?

Examples of hazards to human health

- dioxin in chickens,
- hormones in beef,
- mad cow disease (BSE),
- *E. coli* bacteria in vegetable sprouts,
- antibiotics in honey,
- melamine in milk,
- technical salt in food,
- insecticide fipronil or salmonella in eggs.

Fundamental principle of EU food safety policy

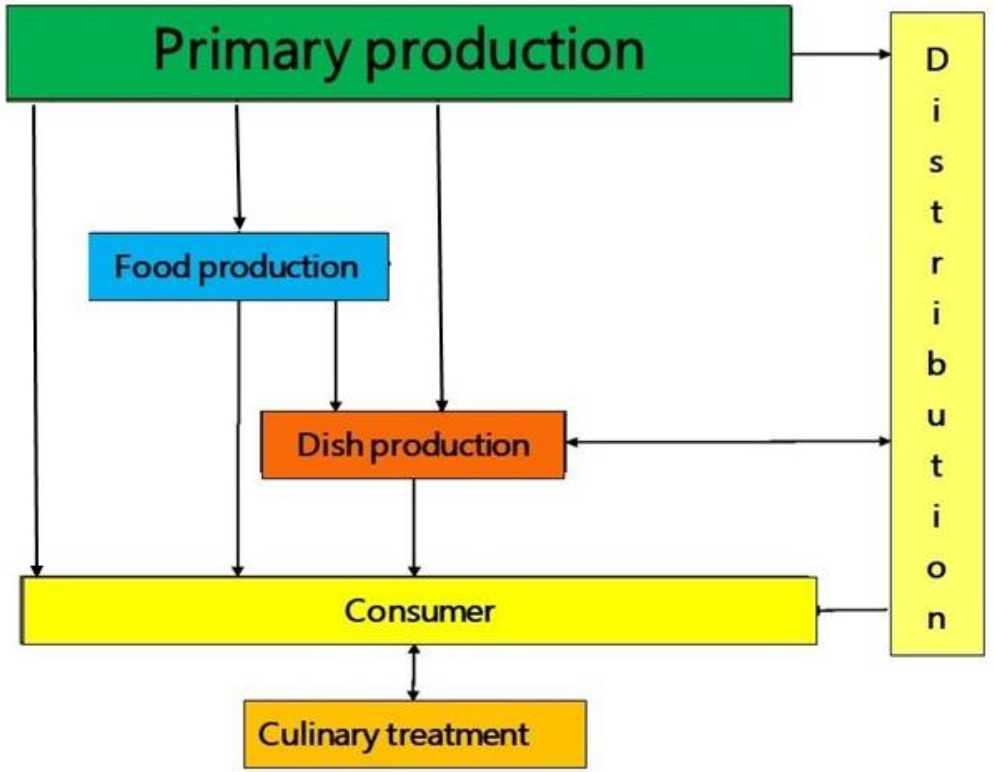


- application of the integrated approach „from farm to table“ (or from pitchfork to fork)
- these principles involves all the way from primary production, acquisition of food commodities, its processing and food production and distribution and catering to the consumer.

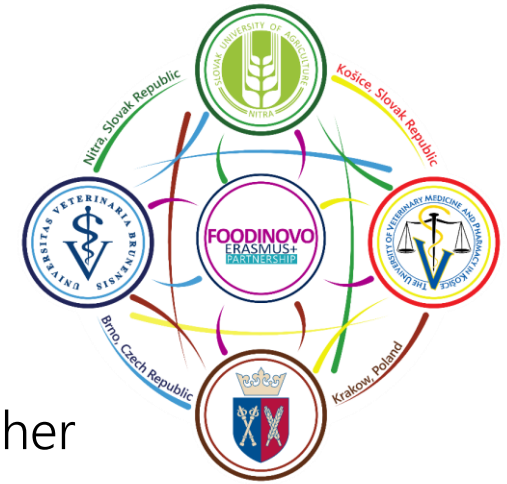
Food Chain

Primary production – production, rearing or growing of primary products including harvesting, milking and farmed animal production prior to slaughter, also includes hunting, fishing and gathering wild fruits.

Production, processing and distribution - means any stage, including import, from and including the primary production of food, up to and including its storage, transport, sell or supply to the final consumer and, where relevant, the importation, production, manufacture, storage, transport, distribution, sale and supply of feed.

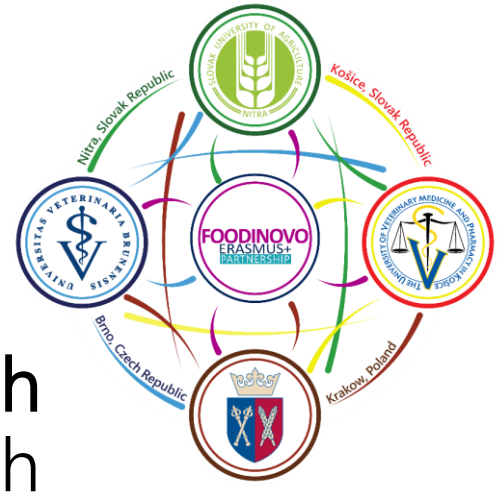


Food processing



- transformation of agricultural products into food, or of one form of food into other forms.
- includes grinding grain to make raw flour to home cooking to complex industrial methods used to make convenience foods.
- primary food processing is necessary to make most foods edible,
- secondary food processing turns the ingredients into familiar foods, such as bread
- tertiary food processing has been criticized for promoting over nutrition and obesity, containing too much sugar and salt, too little fiber, and otherwise being unhealthful

Elements of the system "from farm to table"

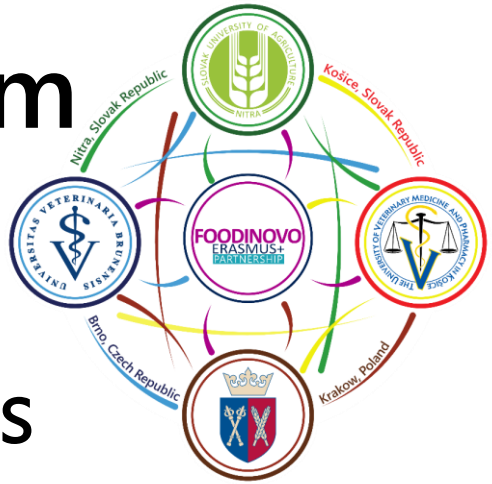


- food safety policy based on an **integrated approach** from the perspective of the entire food chain which covers food and feed,
- application of the principle of food **traceability** feed and components thereof in the entire food chain,
- the principle of legislation **transparency** for food safety,

Elements of the system "from farm to table"

- the **principle of caution and prevention** to protect human health,
- improve **communication** with the consumer and **informing** consumers about the safety of food produced,
- application of the **three components of risk analysis**: risk assessment (scientific assessments and information analysis), risk management (regulating and controlling), communication about risk

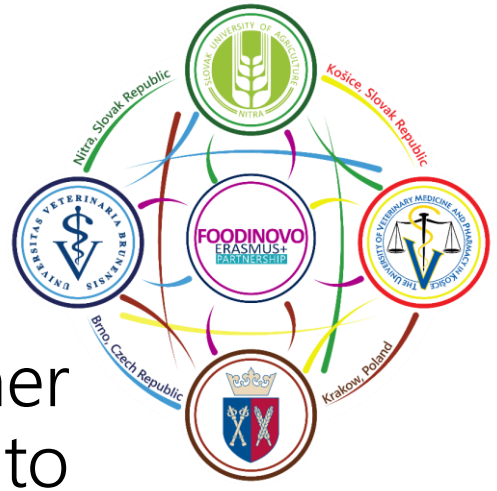
Elements of the system "from farm to table"



- functioning **rapid alert systems** and **crisis management,**
- creation of an independent scientific and consultancy body – **European Food Safety Authority** (EFSA).

What is food ?

(Regulation of the European Parliament and the Council no. 178/2002)

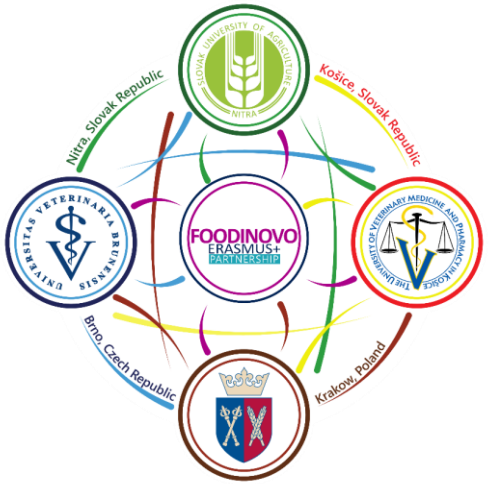


- **„Food" includes:** any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans, this includes drinks, chewing gum and water.

- **"Food" shall not include:** feed, live animals unless they are prepared for placing on the market for human consumption, plants prior to harvesting, medicinal products, tobacco and tobacco product, narcotics or psychotropic substances, residues and contaminants.

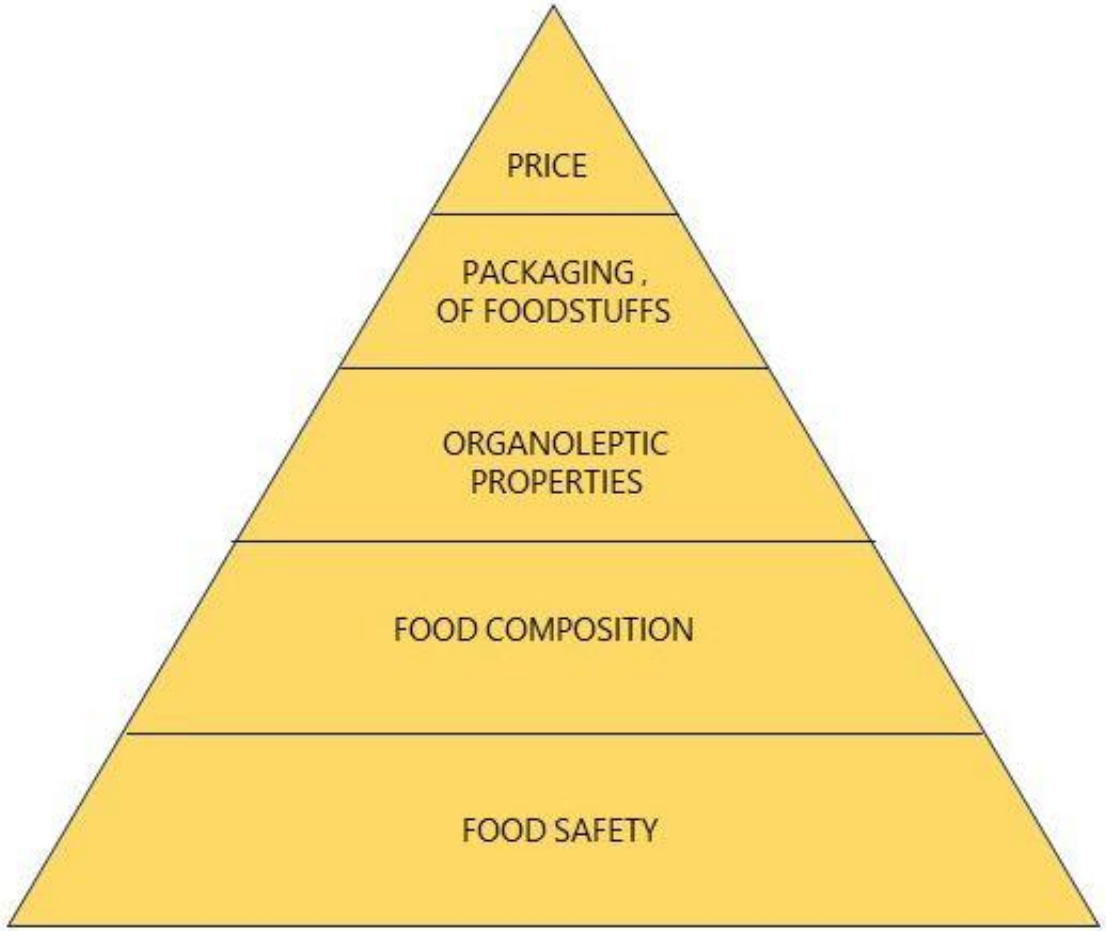
What is feed ?

(Regulation of the European Parliament and the Council no. 178/2002)



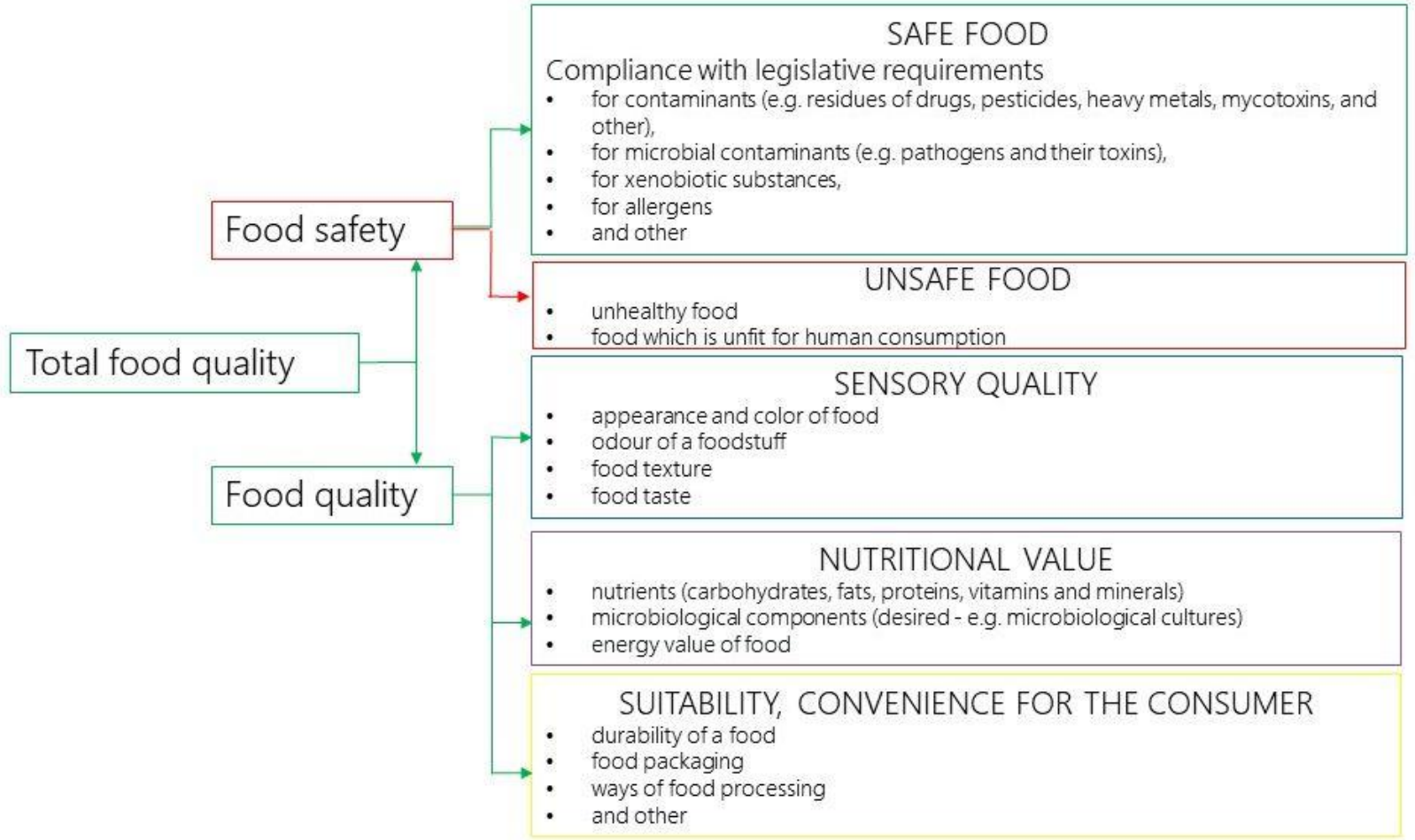
- „Feed" (or "feeding stuff") means any substance or product, including additives, whether processed, partially processed or unprocessed, intended to be used for oral feeding to animals

Food safety

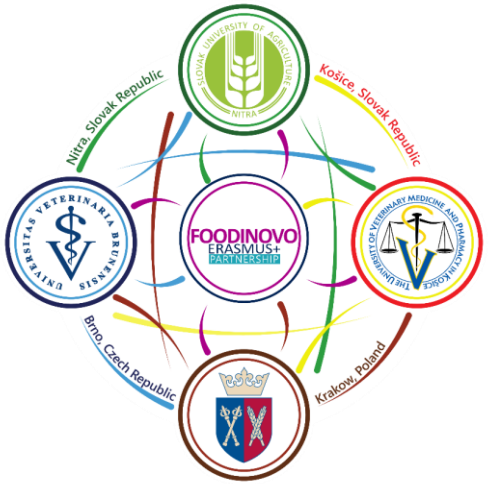


Sometimes may be food safety associated with other aspects important for consumers, then we are talking about the total quality of food

Food quality

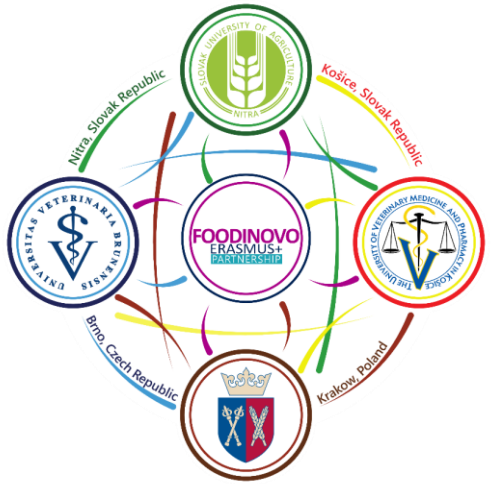


Food safety



- It is the basic and most important food properties
- Requirement for food safety is enshrined in the Regulation of the European Parliament and the Council no. 178/2002, General requirements of food law (Article 14) - According to it, **food shall not be placed on the market if it is unsafe.**

Food is considered to be safe:

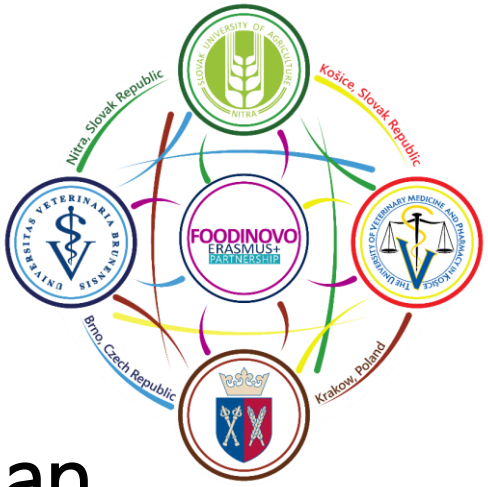


- **if it is not injurious to health** (does not contain pathogens, toxic substances, etc.)

In determining whether any food is injurious to health, regard shall be had:

- not only to the probable immediate and/or short-term and/or long-term effects of that food on the health of a person consuming it, but also on subsequent generations;
- to the probable cumulative toxic effects;
- to the particular health sensitivities of a specific category of consumers where the food is intended for that category of consumers.

Food is considered to be safe:

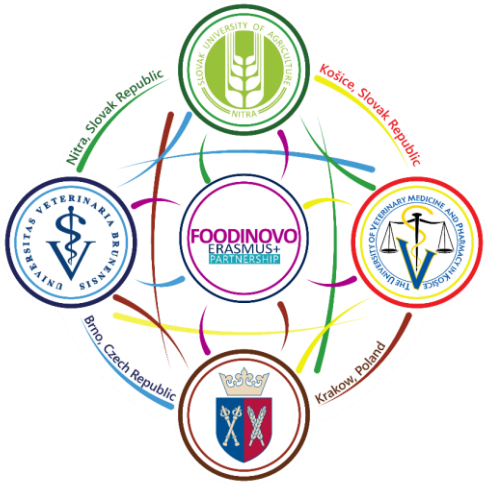


- if it is fit for human consumption.

In determining whether any food is unfit for human consumption, regard shall be had to whether the food is unacceptable for human consumption according to its intended use,

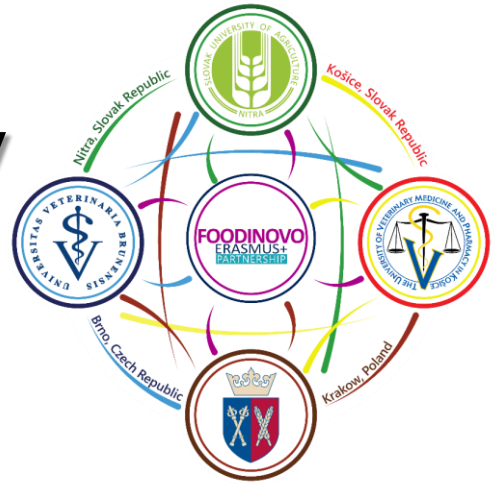
- for reasons of contamination, whether by extraneous matter or otherwise,
- or through putrefaction, deterioration or decay
- where was exceeded hygienic limits set by law (microbiological limits, limits for additives, etc.)

Hazard assessment



- Short-term effects
- Long-term effects
- To the probable cumulative toxic effects
- Specific effects (weakened immunity, allergy)
- Method of use (treatment of foodstuffs, frequency)
- Feed safety
- Informing the public
- Batch – one dangerous goods ➞ the entire batch is dangerous (withdrawing food from the market)

Hazard and Risk in Food Safety

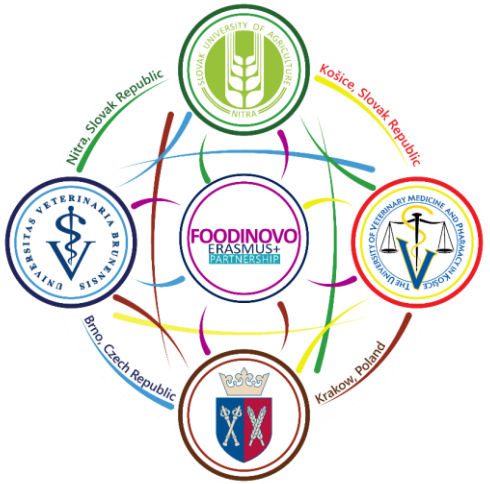


Hazard ≠ Risk

- **"hazard"** means a biological, chemical or physical agent in, or condition of, food or feed with the potential to cause an adverse health effect

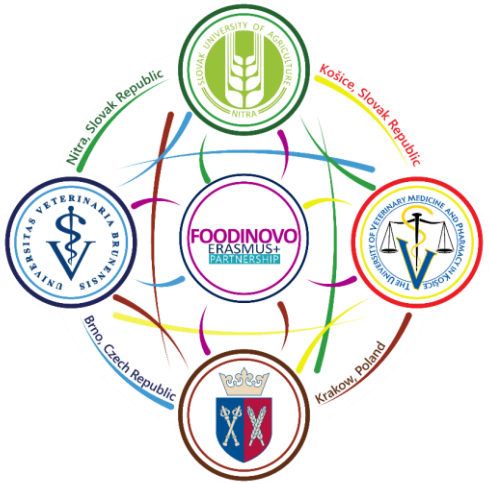
- **„risk"** refers to the probability that the effect will occur

Risk assessment



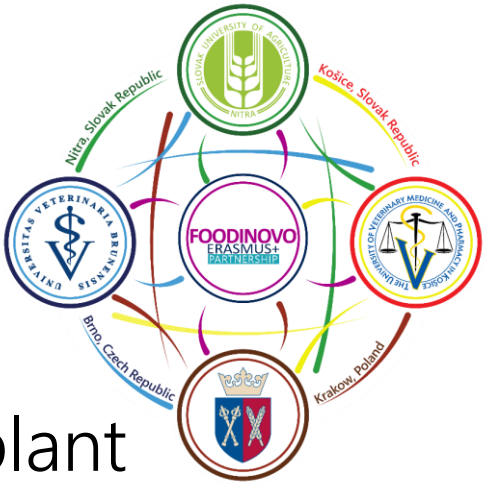
- based on the collection and analysis of information obtained in research institutions, as well as in routine monitoring
- it is very important to obtain information from consumers

Risk assessment



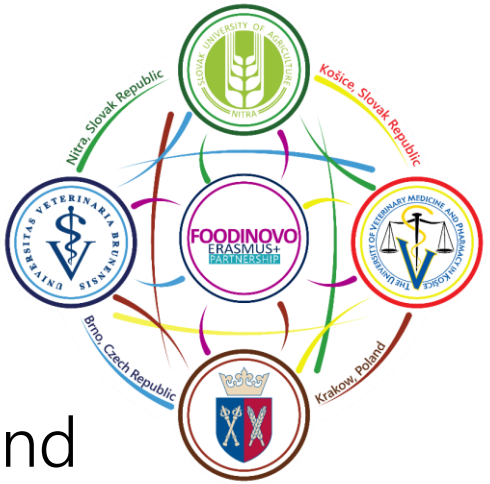
- Hazard Identification
- Hazard Characterization
- Exposure Assessment
- Risk Characterisation

Hazard and risk from food



- Foods containing naturally occurring chemicals plant or animal origin.
- It can get into contact with a number of microorganisms, objects, and naturally occurring or man-made substances.
- All potentially harmful agents in food are called hazards from food.

Categories of Hazards



Biological hazards

- may include bacteria, viruses, insects, plants, birds, animals, and humans

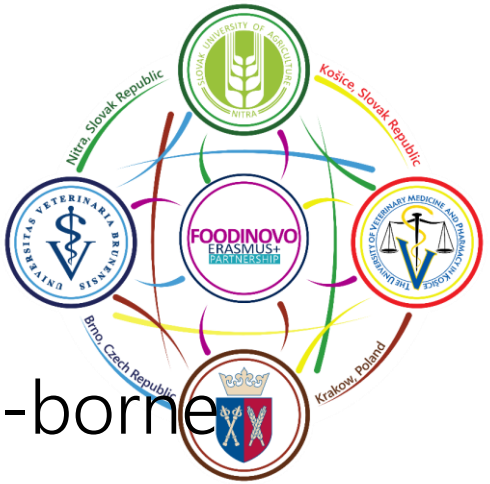
Chemical hazards

- include compounds that can cause illness or injury due to immediate or long-term exposure

Physical hazards

- include foreign objects in food that can cause harm when eaten, such as glass or metal fragments

Biological hazards



- Health hazards caused by living organisms, food or food-borne represent microorganisms and parasites
- Food-borne diseases can be caused by consuming food or water contaminated by pathogenic microorganisms
- Because of the potential consequences and the number of affected the biological hazards are the most significant.

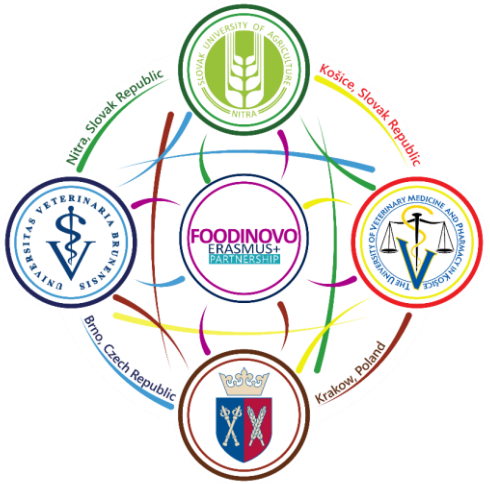
Biological hazards

- Development of new technologies and other factors affect the growing significance of new forms of pathogenic microflora - decreasing of "classical" poisoning, increasing the number of listeriosis and campylobacteriosis.

- Changes in eating habits also contribute to the changes in the spectrum of the disease.

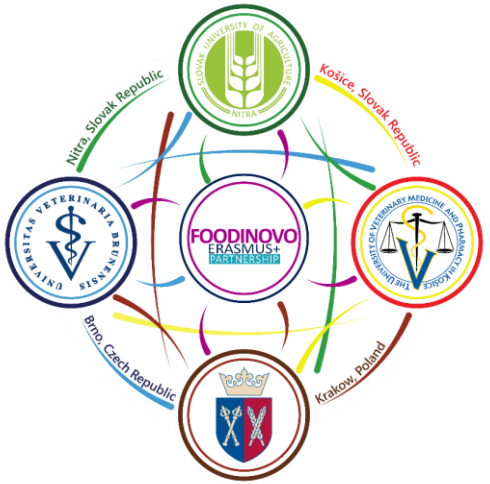
- The trend of the number of the disease can also be affected by the development of investigative methods and frequency of testing.

Biological hazards



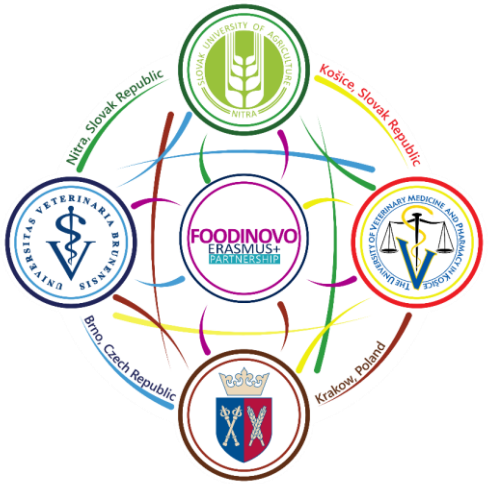
- The process of spreading foodborne illness has its own laws.
- The investigation of cases and investigation of the causes is often detected gross violation of the rules of hygiene.
- Is necessary to educate workers in the food industry about the principles of spread of disease from food.

Biological hazards



- Fungi (yeasts and molds) may cause a mycosis mycotoxicoses.
- Biological hazards are parasites.
- Human viruses cannot grow in foods. However, they can persist for a long time.
- Another biological hazards are infectious prions.

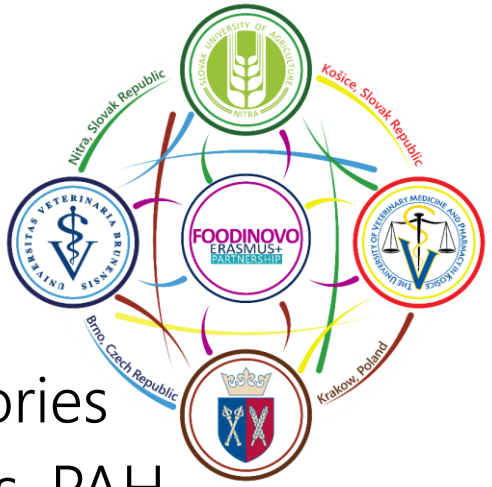
Chemical hazards



- Chemical hazards are posed by chemical substances in food or in meal, which may cause damage to the health of the consumer, i.e. any acute or chronic intoxication or individual undesirable reaction of the organism.

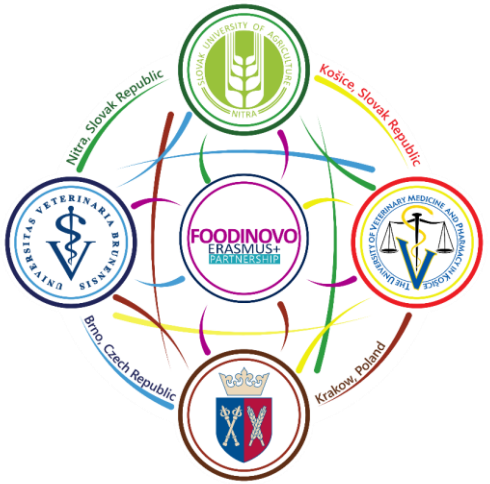
- A chemical hazard is any substance that can cause a health problem when ingested or inhaled. They include toxins, dangerous chemicals, residue of excess chemicals used in processing food products.

Chemical hazards



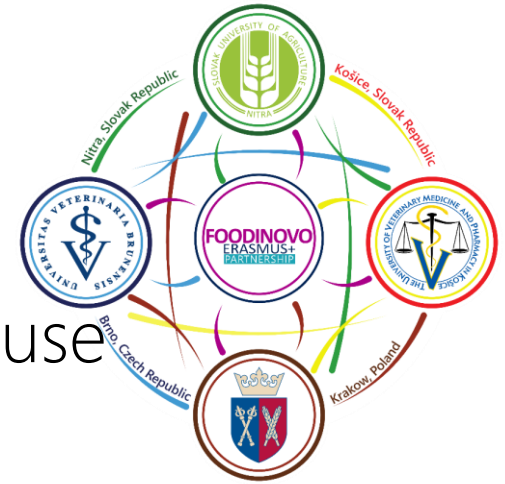
- **Industrial contaminants** are man-made substances produced by factories
- **Organic pollutants** - tetrachlorodibenzodioxin, aliphatic hydrocarbons, PAH (polyaromatic hydrocarbons), N-nitrosamines, phthalates, PCBs (Polychlorinated biphenyls), organometallic compounds and etc.
- **Inorganic substances** - lead, cadmium, mercury, arsenic, tin, aluminium, chromium, copper, nickel, iron, zinc
- **Radionuclides** - strontium, caesium, iodine
- **Naturally occurring toxicants** - histamine, glycoalkaloids, tyramine, **erucic acid**
- **Process contaminants** are substances that form in food or in food ingredients when they undergo chemical changes during processing. Processing methods include fermentation, smoking, drying, refining and high-temperature cooking

Chemical hazards



- **Mycotoxins** are toxic compounds that are naturally produced by certain types of moulds (fungi). Moulds that can produce mycotoxins grow on numerous foodstuffs such as cereals, dried fruits, nuts and spices.
- **Pesticide residues** are widely used in producing food to control pests such as insects, rodents, weeds, bacteria, mold and fungus.
- **Residues of Veterinary Medicinal Products** - Food-producing animals may be treated with veterinary medicines to prevent or cure disease. These substances may leave residues in the food from treated animals.
- **Additives** - in the correct use it isn't health hazardous
- **Allergens** - chemical hazards that must be addressed only in relation to a particular group of consumers

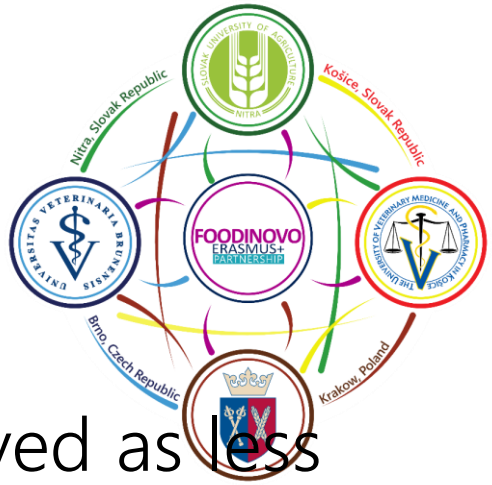
Physical hazards



Physical hazards include foreign objects in food that can cause harm when eaten, such as glass or metal fragments.

- **endogenous** - from raw materials (stone, clay, sand, shells, shell, bone, cartilage, hair, feathers)
- **exogenous** - from the environment (personal items (various pins and buttons from working clothes, cigarettes, coins, textiles, etc. section.) contamination of Technology and Environment (rust, peeling paint, broken glass, screws, equipment parts, plaster, etc.))

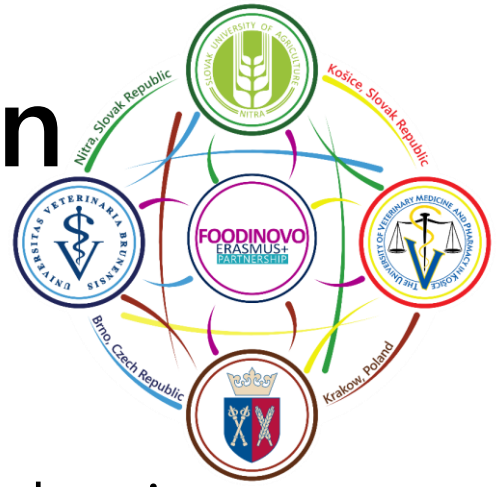
Chemical and physical hazards



- From the viewpoint of potential consequences is perceived as less significant compared with biological hazards.

- This hazards is very often caused by human mistake.

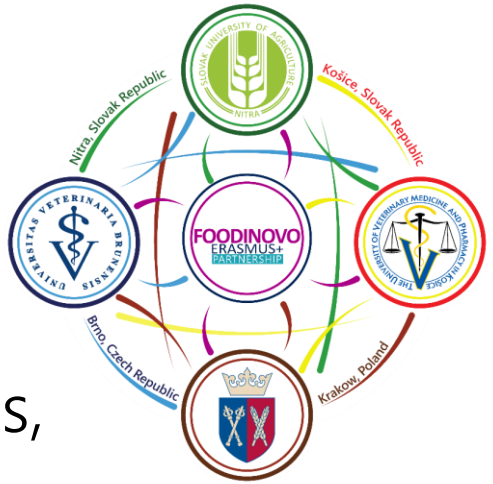
Factors influencing the expansion of health hazards from food



The general causes of development of hazards during production, storage and distribution of food (and dish) are:

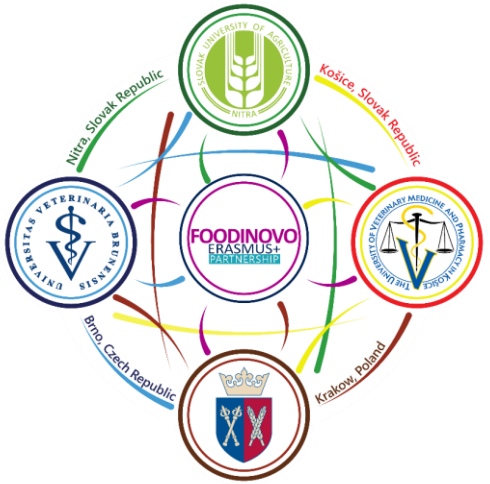
- primary contamination
- multiplication
- survival
- secondary contamination
- consumers sensitivity in population

Primary contamination



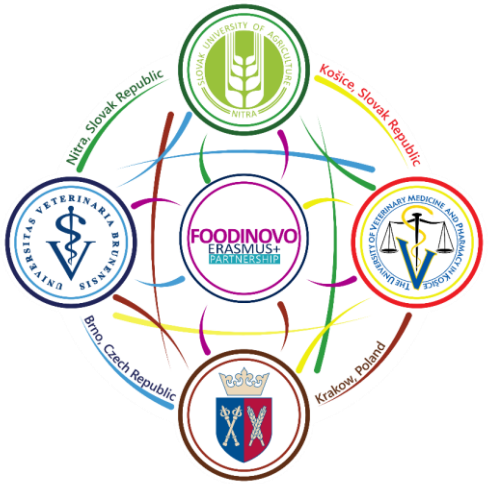
- Contamination of the food products such as meat, vegetables, and fruits is possible by the introduction of the parasite from the sewage, irrigation water, feces, soil, human handling or improper process of the infected meat.
- Meat, raw veggies, eggs and milk can be contaminated with e-coli, salmonella or other food borne pathogens before they even reach the processing plant. These products can be exposed through the contact with animal feces, bacterial infection, and contaminated ground water.
- According to the Center for Disease Control and Prevention, eggs are often contaminated before they are deposited by the hen, through salmonella present in the hen's ovaries.

Multiplication



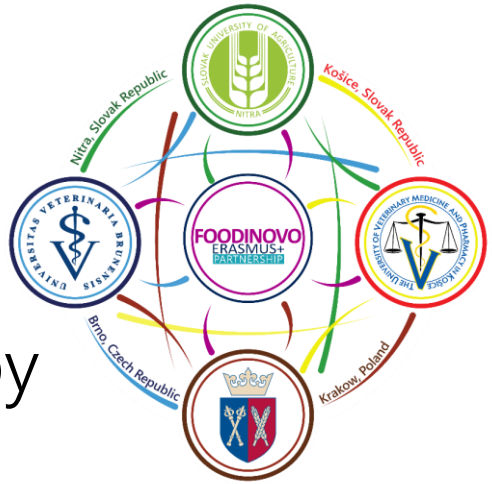
- During processing may occur to multiplication of microorganisms and the toxin production (failure of technological processes)
- Presence does not mean the health hazard or spoilage of foodstuffs - only in the case of microbial growth

Survival



- Ineffective technological process of food production - insufficient heat treatment of food
- Usually in combination with other factors - high contamination of raw materials

Secondary contamination



- Safe food, raw materials or other can be contaminated by microorganisms, e.g. by cross-contamination.

- Cross-contamination of food is the transfer of harmful microorganisms between food items and food contact surfaces. Prepared food, utensils and surfaces may become contaminated by raw food products and microorganisms. These can be transferred from one food to another by using the same knife, cutting board or other utensil without washing it between uses. A food that is fully cooked can become re-contaminated if it touches raw foods or contaminated surfaces or utensils that contain pathogens.

Consumers sensitivity in population

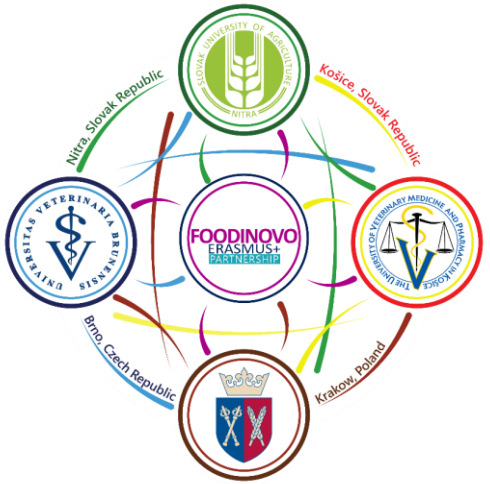
- The disease can be cause only with an infective dose of the microorganism or toxin.
- The only presence of pathogenic bacteria, or toxin in a food or dish may not lead to disease.
- Minimal infective dose (MID) is traditionally been used for bacteria that contaminate foods that cause infection in or from the digestive tract. MID was defined as the number of bacteria ingested (the dose) from which a pathology is observed in the consumer.
- Small children, the very old people and the sick people have lower infectious dose

PHYSICAL HAZARDS

Physical hazards

- In the literature are used for it different definitions
- It can be caused by a foreign object
- It can be defined as anything that is perceived by consumers as something that is inappropriate in food
- Foreign body may be classified as a physical hazard only if it can damage the health of consumers
- Otherwise, the danger will be assessed on a piece of paper in food for adults and otherwise in food for babies
- A foreign object in food is when someone discovers an object in their food or meal that they would not reasonably expect to be there. Pieces of rocks, glass, plastics or metal may be found in food and cause serious injuries to your teeth, gums, throat or digestive tract

Physical hazards



- especially mechanical impurity, such as sharp or hard objects
- can damage the health of the consumer
- broken glass, hard plastics, nails, splinters, parts of equipment and tools, plaster, stones, etc.

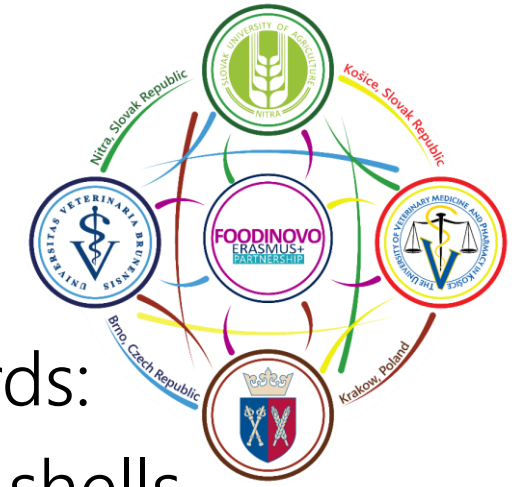
Physical hazards

Food of animal origin may be the source of some physical agents that are dangerous to human health.

Practically, we can divide it into two basic groups - foreign objects and radionuclides.

- Foreign objects in foodstuffs are any undesirable solid objects occurring in foods range from subjects that have nothing to do with food (e.g. cullet or metal objects) to objects food origin such as bone or stalks of fruit.
- Radiation is caused by the decay of radionuclides (radioisotopes) - radionuclides are present in all life forms. Possible sources include permanent formation in the atmosphere by cosmic rays, nuclear weapons testing, nuclear reactors accident.

Physical hazards

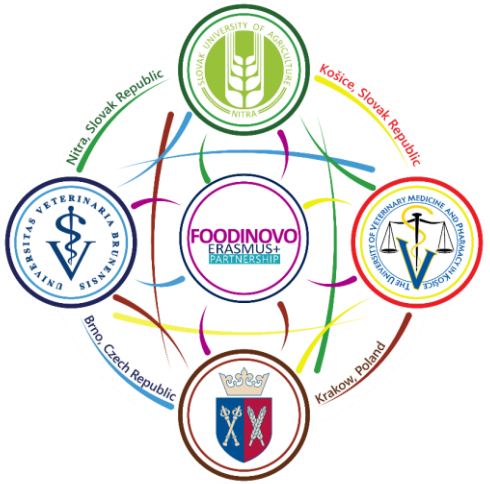


According to the source, we can divide the physical hazards:

a) endogenous (raw materials) - e.g. stones, earth, sand, shells, husks, bones, cartilage, hair, feathers

b) exogenous (from the environment.) – e.g. personal items (various pins and buttons from working clothes, cigarettes, coins, parts of fabrics, etc.), contamination from technology and environment (rust, flaking paint, broken glass, screws, pieces of equipment plaster, etc.).

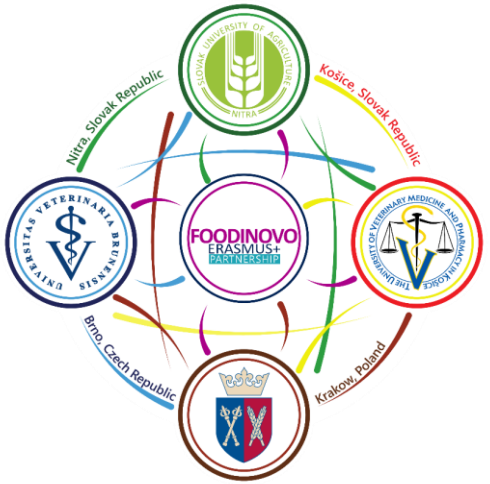
Types of foreign objects



Dividing physical hazards from food can be done by several factors, for example:

- according to the material,
- according to the size
- according to the negative effects on human health.

Sources of foreign objects



- from primary production (e.g. from fields - stones, metals, insects, unwanted parts of plant material, studs, wood, dirt, small animals)
- from food processing and handling (bones, glass, metals, plastics, wood, nuts, screws, wire, clothing, oil, flaking paint, rust, etc.)
- from the distribution channels (insects, metals, dirt, stones)
- materials deliberately incorporated into food (sabotage employees)
- other materials (jewellery, paper clips, etc.)

Glass

- the most common source of glass in food are raw materials
  - contamination occurs directly during primary production
  - raw material may be contaminated from the glass food packaging

- contamination can also occur during production
  - glass containers
  - part of processing lines made from glass
  - from broken cover of lights

- the problem is filling foods or meal in glass jars or bottles, especially for re-use.

Metal

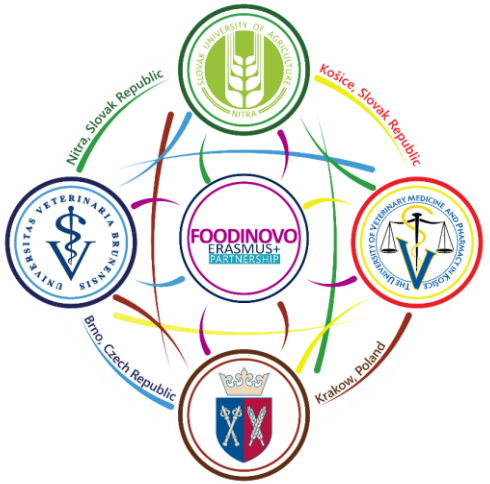
- Metallic foreign bodies can contaminate food or meal
  - during primary production
  - during production
- The most common sources of contamination:
  - processing facilities (especially if not properly maintained in perfect condition, which can be broken off parts of them)
  - maintenance work (uninformed handyman forget to collect all the scattered bolts or cloves)
  - broken needles in meat
- also, a frequent source of contamination by metal particles is opening cans with food
- contamination can occur from containers with metal clasps or rings.

Natural materials

From natural materials in the food or meal may occur

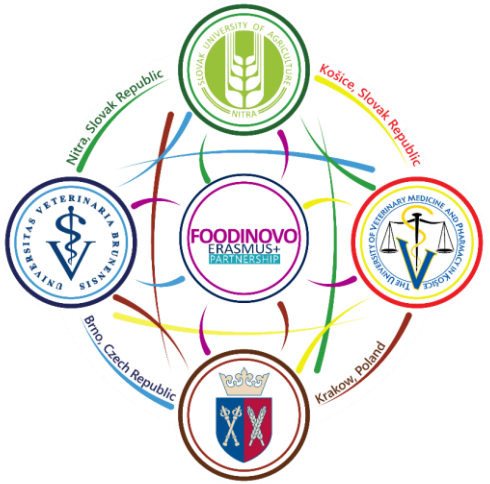
- small stones (especially primary production of food of plant origin, contamination occurs mainly during harvest and storage directly in the field, without the use of a suitable backing foil)
- wood
  - especially from raw materials of plant origin
  - packaging (pallets or wooden crates)
  - wood used in processing of products (such as cutting boards, workbenches or wooden spoons, bowls or baking forms)
  - sawdust used for smoking
  - wood may also be included in foods (e.g.. wooden handle in ice cream or in traditional fish products such as pickled rollmops)

Small pests



- aren´t only microbiological risk
- can cause choking, damage to the lining of the digestive tract
- linked to all stages of production and processing
- they can even get into the stored finished product
- recorded contamination by larger animals, like mice in bread, or small reptiles or spiders in the pack of exotic fruits

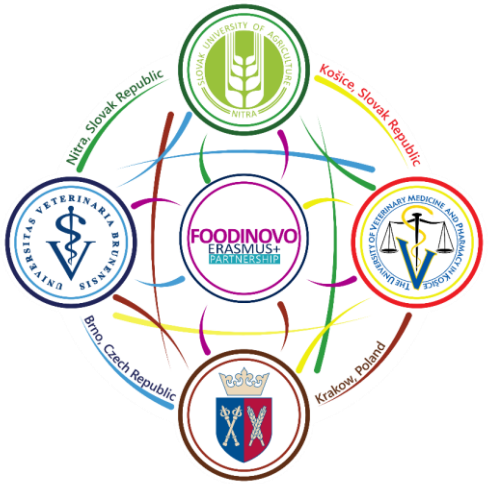
Other materials



- paper
- board
  - the most common source is packaging materials and paper recording sheets in the processing food
  - is particularly dangerous for very young children
- rubber
  - the most common source of rubber is gaskets and conveyor belts
  - is particularly dangerous for very young children

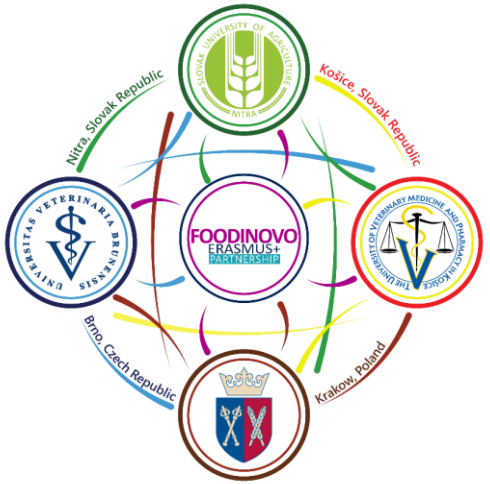
Unwanted parts of food

(raw materials)



- shell
  - eggshell
  - nutshell
- bone fragments
- plumage
- remnants of leaves, stalks
- unshelled grains
- food packaging
- fur
  - from poorly pre-treated raw materials

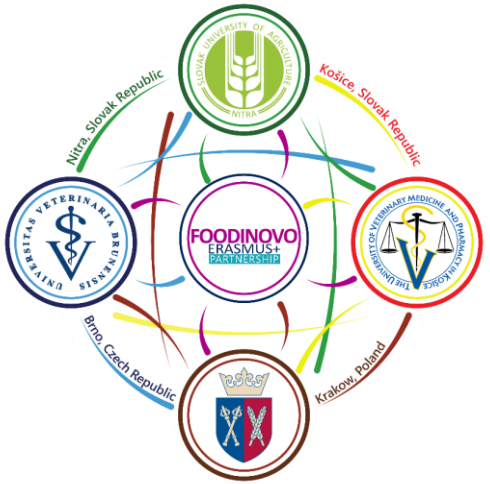
Personal items of staff



- pens, pencils
- rings
- watch
- clips
- paper clip

➢ failure to comply with personal hygiene it gets into food

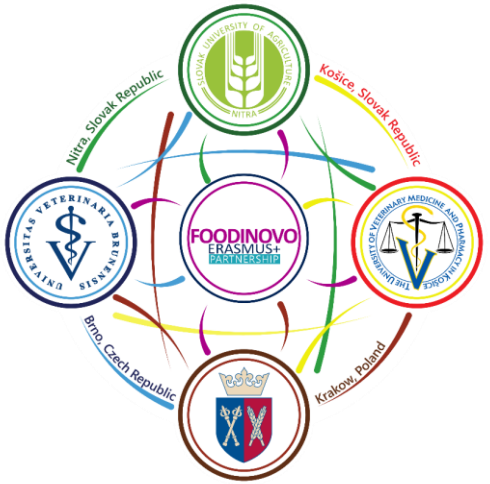
Parts of the organism



- hairs
- nails
- other small, physiologically falling off parts of the human body or animal body

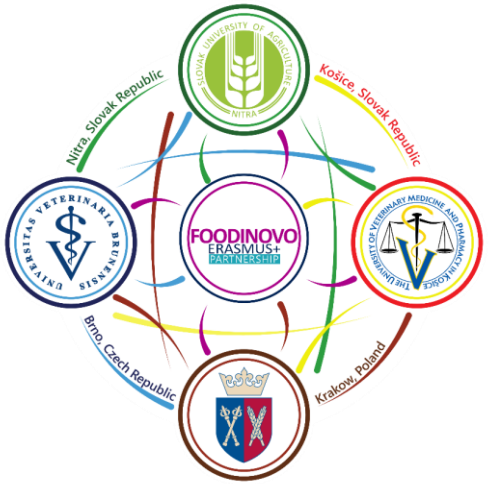
  - risk for consumers
  - most frequent source of hazard may be staffs or visitors
  - when assessing this hazard must be assessed every stage of production or processing

Textiles



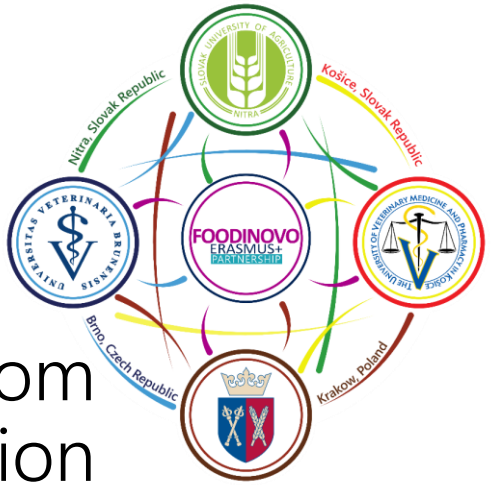
- commonly used textiles
  - textiles used for cleaning, sanitizing and disinfecting the interior food factory or machinery
  - Another possible source of contamination are personal protective clothing
  - this contamination can occur at all stages of production or processing

Radiation contamination



Natural **radiation in food** should not be confused with **food irradiation**. **Food irradiation** is a process that uses ionizing **radiation** to prevent foodborne illness ("**food** poisoning") and **food** spoilage. **Food** is passed through a **radiation** beam–like a large flashlight–to kill bacteria, molds and other pests in **food**

Radiation contamination



- mostly due to a large radiation leak particularly from the energy source or during alienation radiation substances
- some foods (spices, fruits or vegetables) can be irradiated allowed current legislation
- for the treatment of foods such as conservation methods used radiation which deactivates the enzymes in food and devitalized unwanted microflora but at the time of consumption of the food does not already radiation

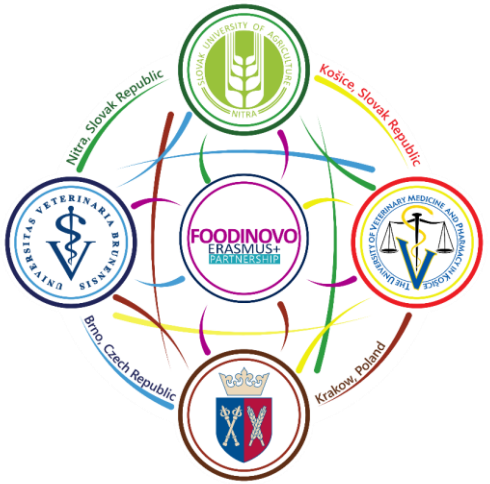
Other hazards

- physical hazards are also stash of microorganisms
  - rings
  - earrings
  - necklace
  - bracelet
  - wathes

- therefore there is a ban on wearing them

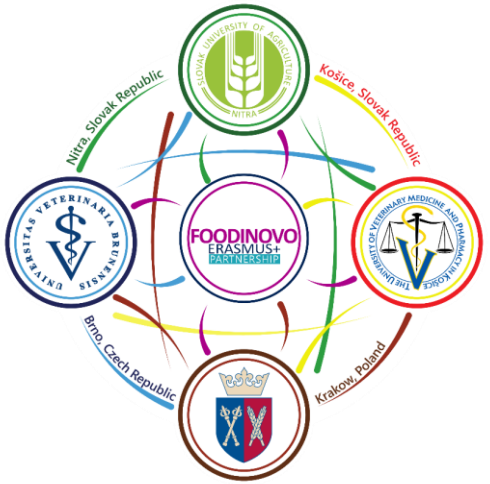
CHEMICAL HAZARDS

Chemical hazards



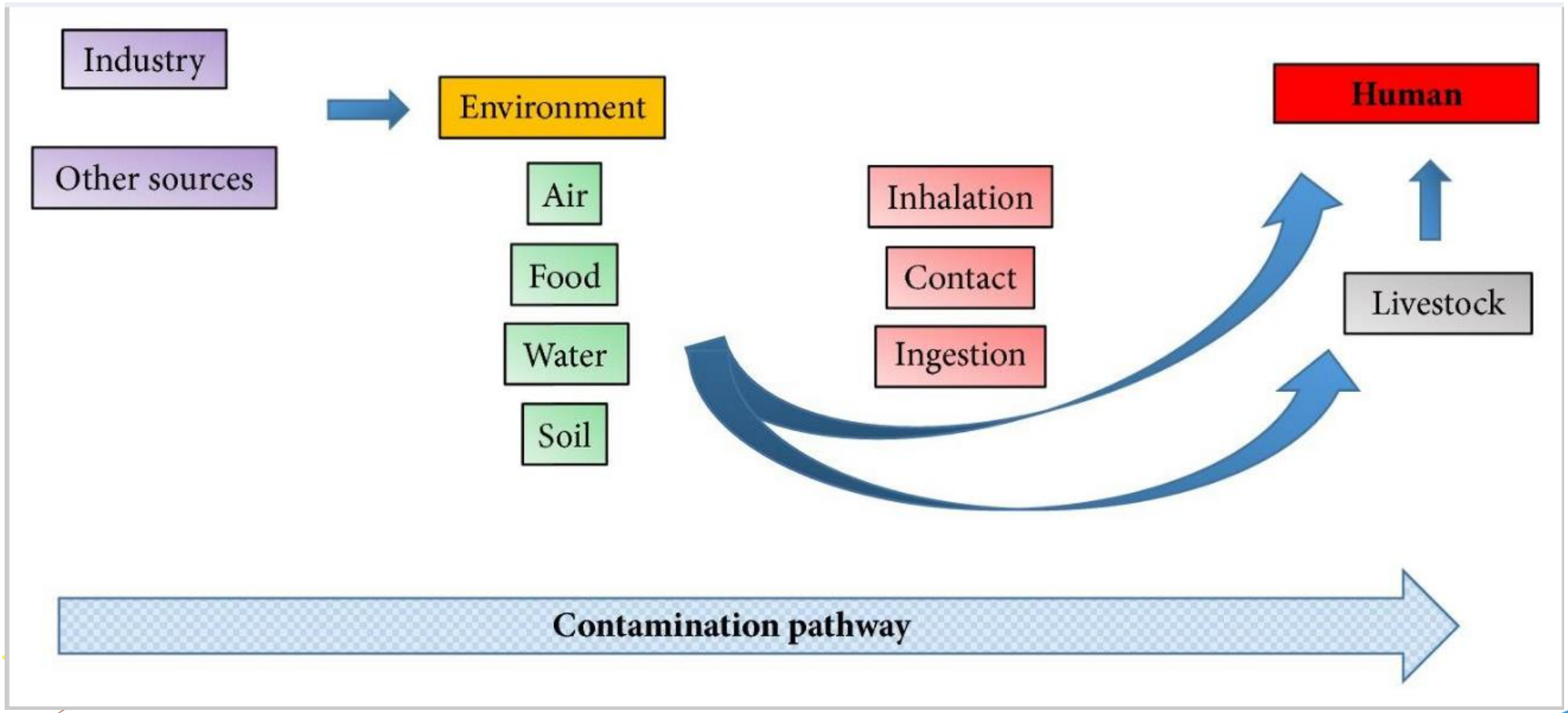
Chemical hazards posed by chemical substances in food or in meal, which may cause damage to the health of the consumer, i.e. any acute or chronic intoxication or individual undesirable reaction of the organism.

Chemical hazards

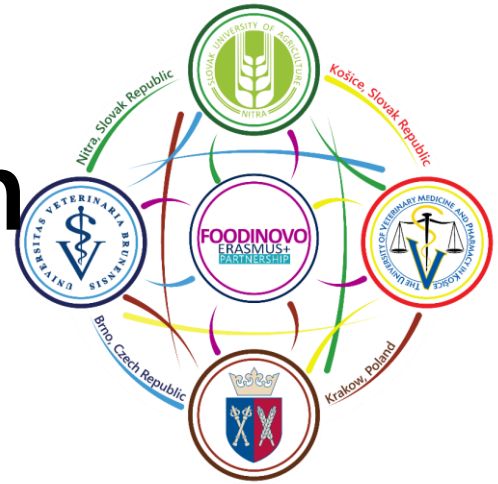


- What comes from?
- How are they harmful?
- How to deal with them?

Chemical hazards



Contamination of production chain



Primary production

- Mycotoxins
- Pesticide residues
- Residues of veterinary drugs
- Metals
- Adulteration

Industrial processing

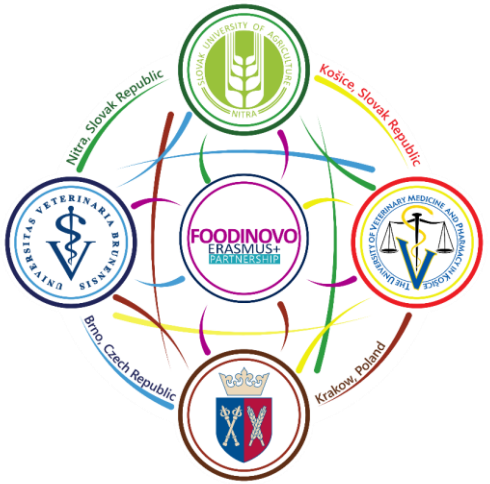
- Food aditives
- Packing migrants
- Processing contaminants

Retailing

- Aduleration
- Packing migrants

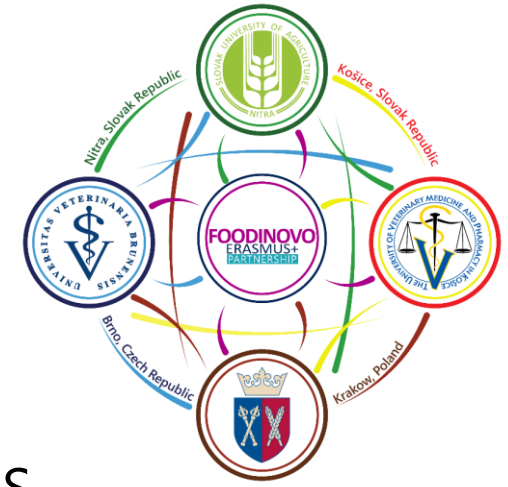
Consumer

- Packing migrants
- Processing contaminants



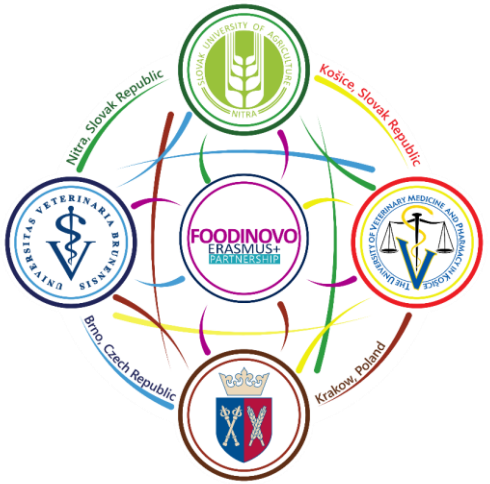
Chemical hazards - natural toxins

Natural toxins



- substances naturally produced by some plants, microorganisms or animals
- may adversely affect the organism, which are consumed
- at low concentrations or under certain conditions, these substances have positive characteristics

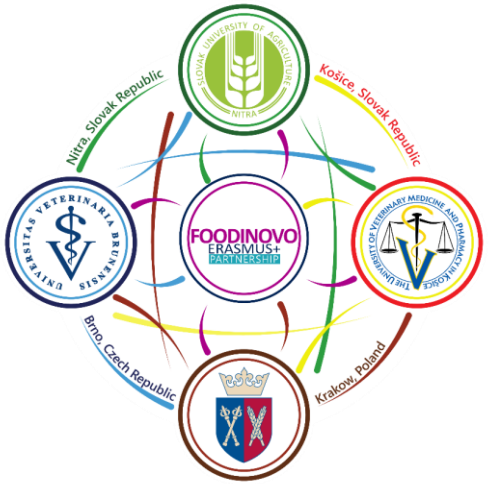
Natural toxins



- Can be formed in food as defense mechanisms of plants, through their infestation with toxin - producing mold, or through ingestion by animals of toxin-producing microorganisms.

- Can cause a variety of adverse health effects and pose a serious health threat to both humans and livestock. Some of these toxins are extremely potent.

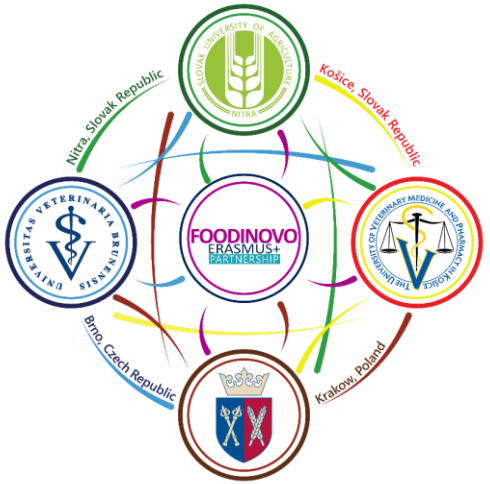
Natural toxins



- Adverse health effects can be acute poisoning ranging from allergic reactions to severe stomach ache and diarrhea, and even death.

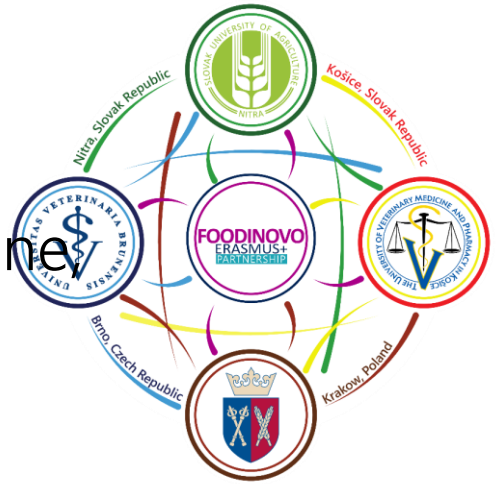
- Long-term health consequences include effects on the immune, reproductive or nervous systems, and also cancer.

What are natural toxins?



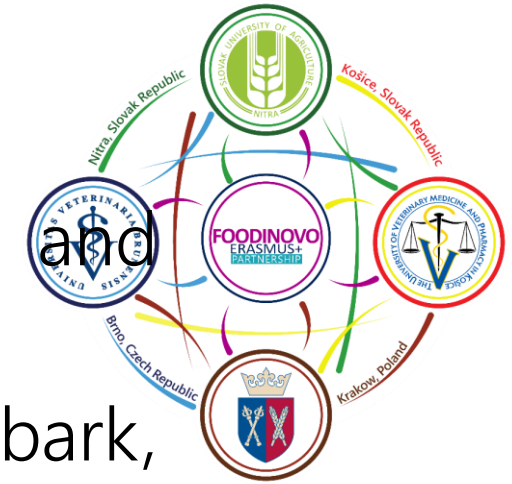
- are toxic compounds that are naturally produced by living organisms
- are not harmful to the organisms themselves but they may be toxic to other creatures
- are produced by plants as a natural defense mechanism against predators, insects or microorganisms
- sources of natural toxins are microscopic algae and plankton in oceans or sometimes in lakes that produce chemical compounds that are toxic to humans but not to fish or shellfish

Dividing of natural toxins



- **alkaloids -** agaritine, nicotine, caffeine, theobromine and theophylline, solanine and tomatine
- **saponins**
- **cyanogenic glycosides**
- **chemicals with estrogenic effects** - isoflavones, pterocarpans, lignans
- **coumarins**
- **lectins**
- **amino acids lathyrogens**
- **analogs of the amino acids arginine**
- **analogs sulfur amino acids**
- **biogenic amines**

Alkaloids

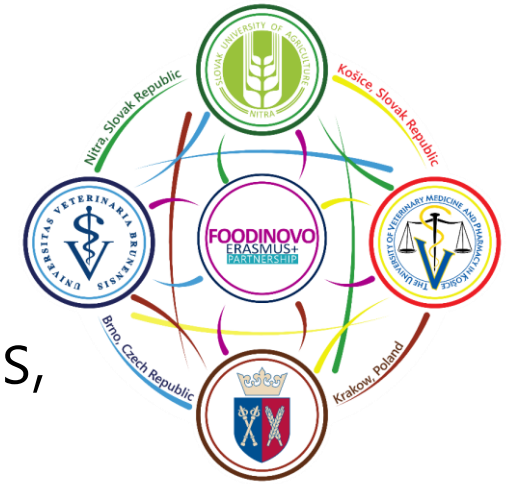


- chemically very big group and their properties and biological effects are very different
- they are contained in the seeds, leaves, roots, bark, and others.
- characterized by an often bitter taste, a burning effect or pungent scent
- often acts as a protection against insects
- in low doses often act as a medicament or as a stimulant of the nervous system, in high doses or prolonged intake acts as a acute poison

Alkaloids

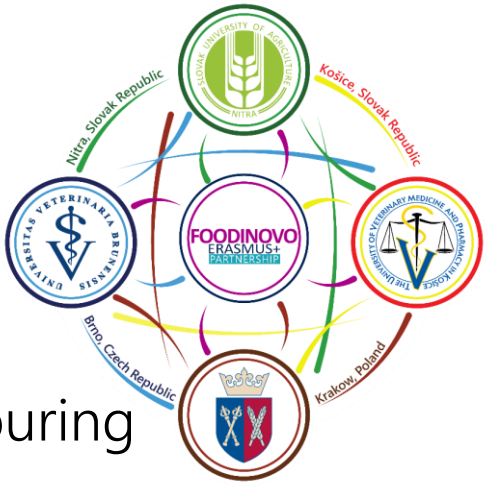
- piperine - a stimulant of the nervous system, has irritating, antimicrobial, insecticidal, antipyretic, but also mutagenic effects
- quinine - inhibiting important enzymes, it is unsuitable for pregnant women and children
- Caffeine - stimulatory effects on the nervous system and the diuretic (dose to 3 mg/kg body weight), higher doses have teratogenic effects and neuroendocrine.
- glycoalkaloids of the Solanaceae plants cause vomiting, stomach cramps, headaches and also have teratogenic effects
- some alkaloids are hepatotoxic and carcinogenic and can cause vomiting, nervous disorders, difficulty breathing, weakness

Agaritine



- present in wild and cultivated Agaricus mushroom species, including the cultivated mushroom *Agaricus bisporus*
- potentially harmful is only eating raw mushrooms because agaritine is very unstable
- by storage at 2 ° C for 5 days, or freezing and thawing is decomposed about 70% agaritine
- by canning is degraded 90% and by the cooking is completely decomposed

Quinine

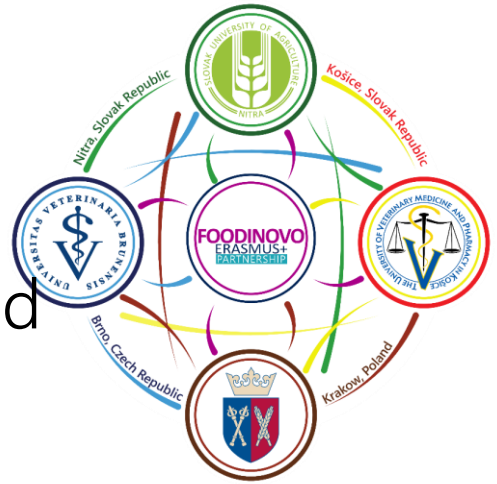


- alkaloids found in the bark of the *Cinchona officinalis*
- in medicine is used as a remedy against malaria fevers
- in the food industry is used as a standard for bitterness and for flavouring soft drinks and alcoholic beverages
- drinks containing quinine are not suitable for pregnant women because they may possibly also cause miscarriage
- typical protoplasmic poison which inhibits various enzymes, locally irritating to tissues and has considerable influence on skeletal muscle

1, 3, 7-trimethylxanthine

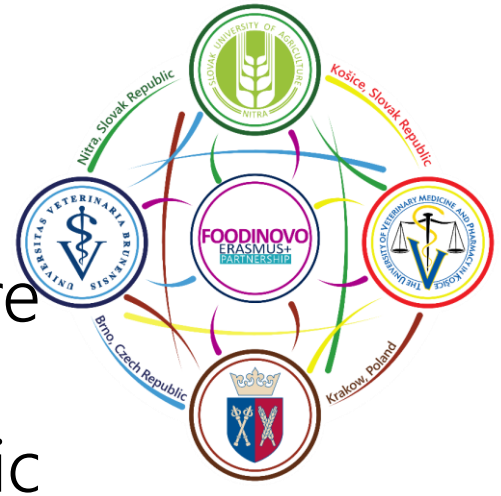
- in small amounts acts as a stimulant of the central nervous system and acts as a diuretic
- addictiveness of caffeine has not been prove
- in children, caffeine can induce states of irritability and anxiety

Glycoalkaloids



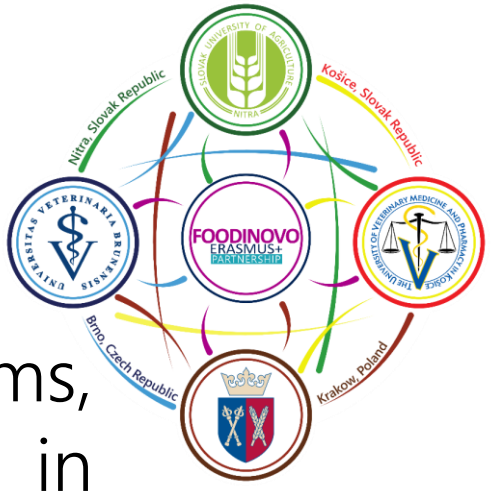
- Potatoes contain toxic glycoalkaloids, solanine and especially chakonin, it act as natural pest control
- the highest concentration of alkaloids under the husk
- under light potato will turn to green - increases the concentration of solanine
- dangerous adult dose - 200 mg solanine
- poisoning by potatoes are rare

Cyanogenic glycosides



- cyanogenic glycosides are natural plant toxins that are present in several plant
- cyanide is formed following the hydrolysis of cyanogenic glycosides that occur during the crushing of the edible plant material either during consumption or during processing of the food crop
- processing methods can detoxify cyanogenic glycosides and reduce the risk of cyanide poisoning.
- processing operations such as fermentation, boiling/cooking, and drying, applied to process food-containing cyanogenic glycosides reduce cyanide content to acceptably safe levels

Occurrence of cyanogen



- in cassava, flax seeds, seeds row fruits like plums, pears, apples, berries, elderberries - especially in the immature fruits and leaves of elderberries

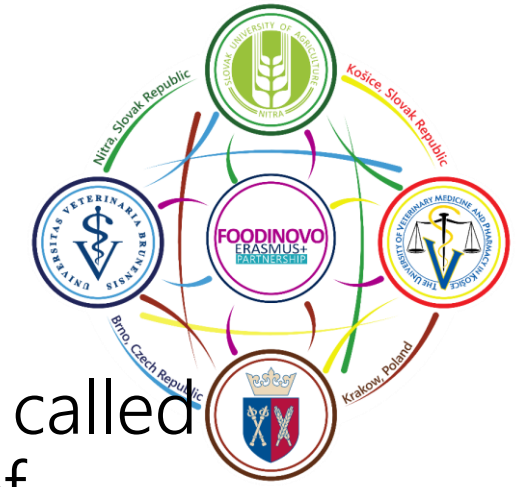
- important cyanogenic glycosides in amygdalin which is in the seeds of bitter almonds and apricots, peaches, plums and cherries

Toxins in fish

Tetrodotoxin poisoning

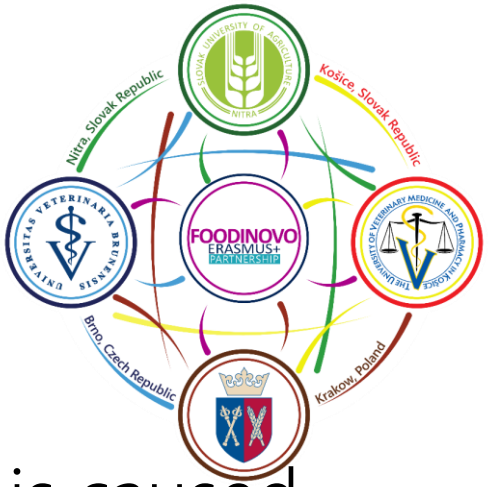
- Tetrodotoxin is a neurotoxin that is most commonly found in marine animals.
- It is famously known to cause perioral numbness in consumers of pufferfish sushi, known in Japan as fugu.
- The toxin is heat-stable, meaning that cooking does not destroy the toxin.
- There are 26 known naturally occurring analogs. The toxin blocks sodium channels leading to gastrointestinal, neurological, and cardiac symptoms in poisoned patients.
- There is currently no known antidote.

Algal toxins



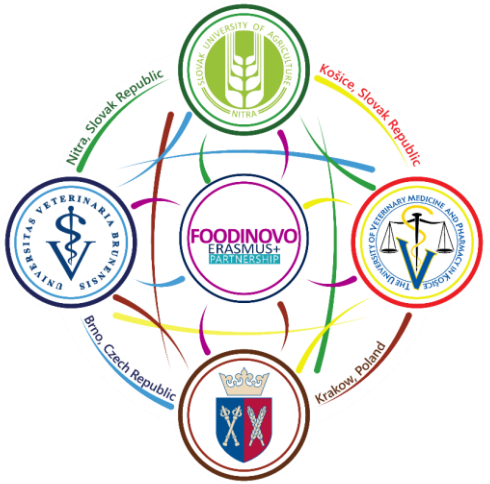
- Toxins formed by algae in the ocean and freshwater are called algal toxins. Algal toxins are generated during blooms of particular naturally-occurring algal species.
- Shellfish such as mussels, scallops, and oysters are more likely to contain these toxins than fish.
- Algal toxins can cause diarrhea, vomiting, tingling, paralysis and other effects in humans, other mammals or fish.
- The algal toxins can be retained in shellfish and fish or contaminate drinking water. They have no taste or smell and are not eliminated by cooking or freezing.

Ciguatera fish poisoning



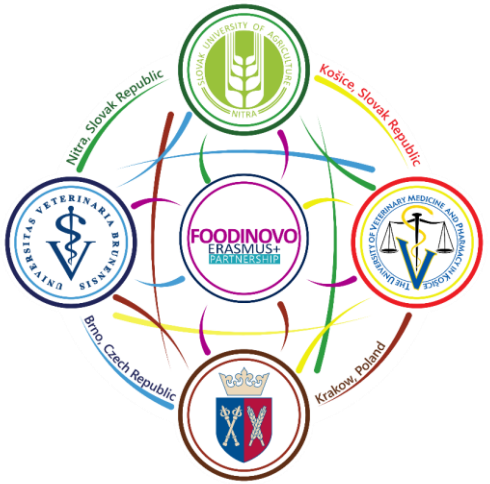
- Another example is ciguatera fish poisoning (CFP) which is caused by consuming fish contaminated with dinoflagellates that produce ciguatoxins.
- Some fish known to harbor ciguatoxins include barracuda, black grouper, dog snapper, and king mackerel.
- Symptoms of ciguatera poisoning include nausea, vomiting, and neurologic symptoms, such as tingling sensation on fingers and toes.
- There is currently no specific treatment for ciguatera poisoning.

Chemical contaminants



- Extraneous contaminants, which are not a natural constituent of foodstuffs
- They are not used as food additives
- Their presence in food may endanger health
- Among the contaminants don´t belong substances which are natural food components and substances which are used as intentional additives or food ingredients

Where comes from?



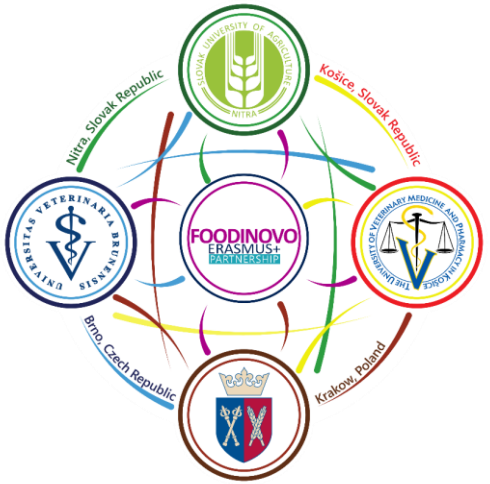
a) from agricultural production

b) from industry and transport,

c) from contamination during manufacturing and storage

d) as a result of microbial contamination

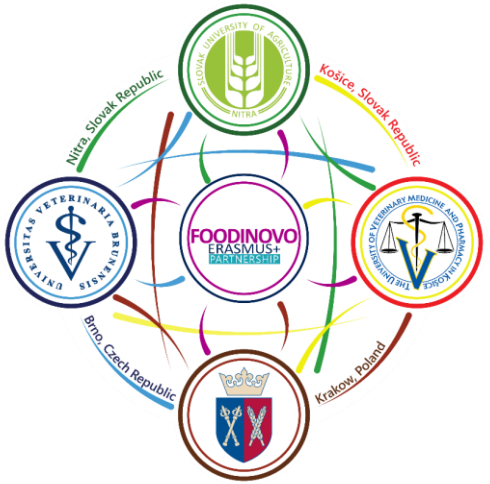
Agricultural production



- Pesticides - in plant and animal foods (after feeding contaminated feed)
- Veterinary drugs
- Fertilizers

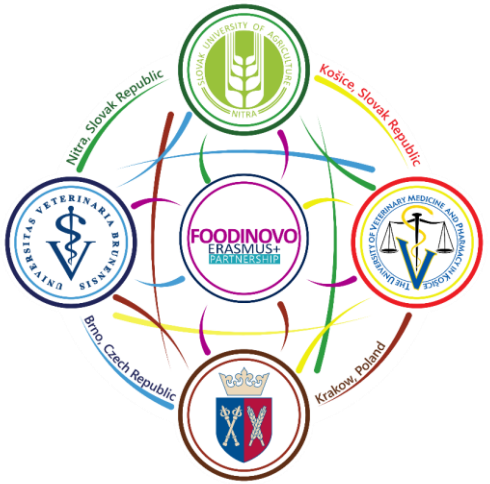
In foods there are only remnants (residue) of these substances in the legislation are set permissible limits

Industry and transport



- industrial wastes
- air pollutants (e.g. exhaust emissions)

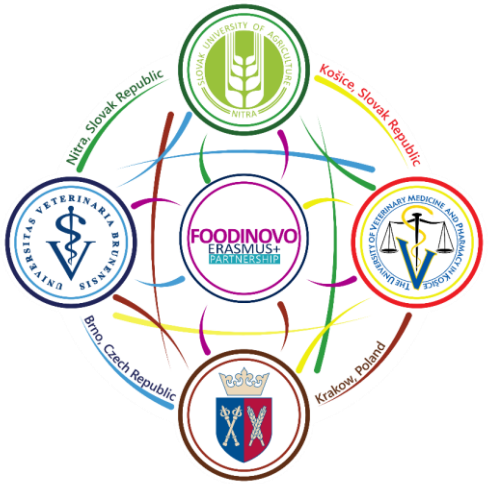
Contamination during manufacturing and storage



- Food during packaging, manufacture, and storage may come into contact with the surface of the machinery, containers and packing materials

- Some dangerous substances result from chemical or physical interventions during processing

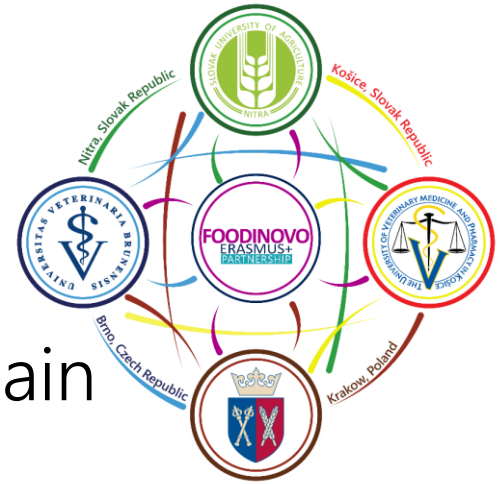
Microbial contamination



- are separate chapter

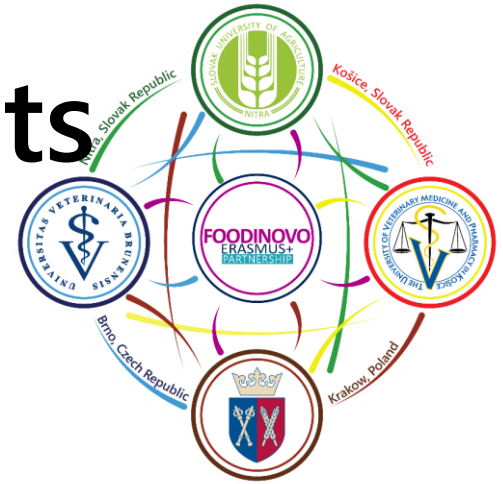
- if, however, the microorganisms produce toxins or harmful substances acting after a conversion, it is also chemical contaminants (botulinum toxin, aflatoxin).

Mycotoxins



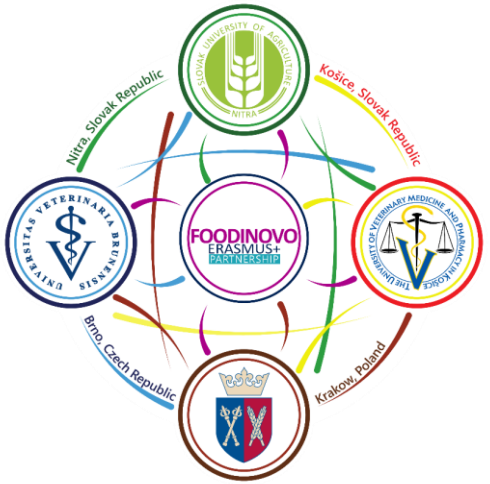
- Mycotoxins are naturally occurring toxins produced by certain molds (fungi) and can be found in food.
- The molds grow on a variety of different crops and foodstuffs including cereals, nuts, spices, dried fruits, apples and coffee beans, often under warm and humid conditions.
- Mycotoxins can cause a variety of adverse health effects and pose a serious health threat to both humans and livestock.
- The adverse health effects of mycotoxins range from acute poisoning to long-term effects such as immune deficiency and cancer.

How are chemical contaminants harmful?



- some are directly toxic
- some will become toxic only after a certain conversion
- mechanism of the effects of contaminants is very different, and the accompany with this there are big differences in the way endanger the health - from neurotoxicity through hepatic carcinogenesis

Pesticides



- plant protection products
- biocide products
- a boom in the use of pesticides occurred in the 30´s of the 20th century
- later found that many active substances are toxic (e.g. DDT, aldrin, chlordane, dieldrin, endrin, lindane) and are very persistent and their amounts in the organism accumulates
- in different countries, many of them have been banned

Pesticides

- **Fungicides**
  - destroying mold
  - preventive or therapeutic use
  - the greatest risk for malformations and carcinogenesis
  - metal-based, inorganic, phthalimides, amides, azoles, benzimidazoles, aniline pyrimidines
- **Herbicides**
  - destruction of weeds
  - different types: selective, non-selective, before growing phase stoppers, total
  - phenoxyacetic derivatives, bipyridyl, ureas, glyphosates…

Pesticides

- **Insecticides**
  - controlling sucking and biting insects and other plant pests
  - types: systemic, contact and fumigation, sucking insecticides
  - cause intoxication of humans and animals
  - e.g. fipronil

- **Rodenticides**
  - they are used for rodent control
  - cause intoxication of animals and children
  - mostly in the form of small pink pellets

Pesticides

Pesticide residues in food chain

- Pesticides can enter the body directly from products treated with pesticides or by-products made therefrom or indirectly
  - from feed into meat, milk, eggs, honey
  - via the soil,
  - via water and air

Entry of pesticides into the body

- Dermal
- Oral
- Inhalation

Health risks

- Acute
  - short-term intake of residues
  - when exceeding the Acute Reference Dose
- Chronic
  - the long-term intake of residues
  - when exceeding the Acceptable Daily Intake (ADI)

Pesticides

Conditions of use pesticides:

- compliance withdrawal period
- no overrun Maximum Residue Levels (MRL)
  - Regulation (EC) No 396/2005 of the European Parliament and of the Council

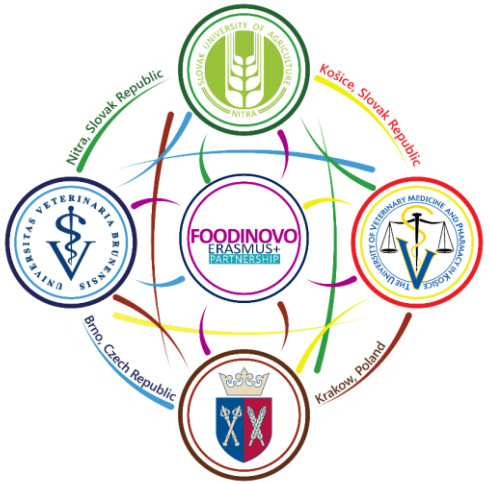
Residue monitoring

- Czech Agriculture and Food Inspection Authority (food of plant origin)
- State Veterinary Administration (food of animal origin)
- Central Institute for Supervising and Testing in Agriculture (feed)

Prevention

- removal of the surface layers of the crop
- hot water washing
- cooking in water with vinegar
- pressing
- blanching
- crop drying
- eating organic food

DDT

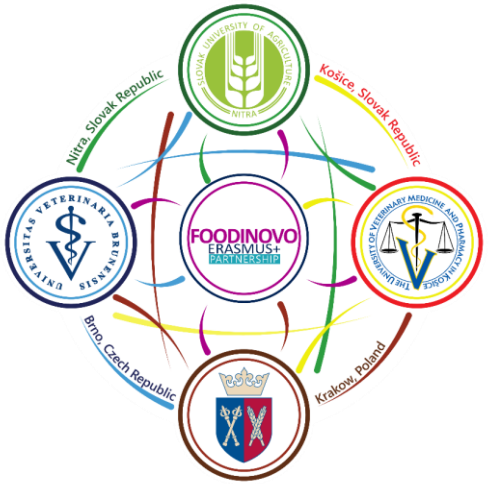


- Organochlorine compound which was used as an insecticide
- In Czech republic DDT use was banned in 1974
- in the world has been rarely used (eg. against vectors of malaria)
- shows cumulative toxicity
- presumed human carcinogens, damages the liver, reproductive system, it causes temporary damage to the nervous system

Dioxins and furans

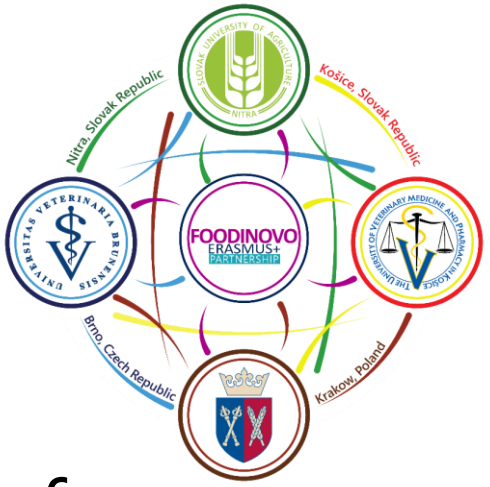
- chlorinated hydrocarbons produced as undesired components for chemical reactions in industrial production, in combustion processes in the presence of chlorine and at atmospheric photochemical reactions
- they have no practical use, so they weren´t specifically produced
- in humans adversely affect the immune and hormonal systems, damage the liver and nervous system
- Some dioxins have also teratogenic and carcinogenic effects
- the main sources are beef and poultry meat and milk

Polychlorinated biphenyls



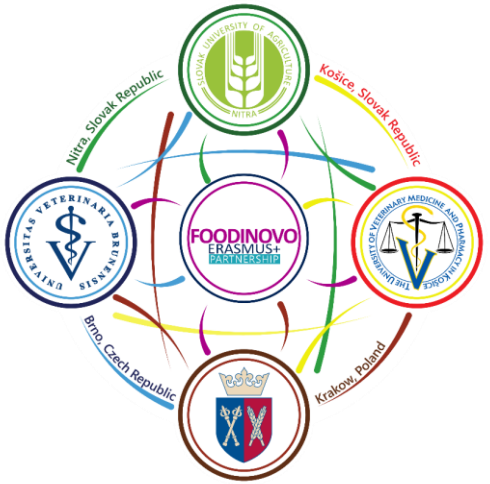
- organochlorine compounds
- 209 chemically related substances
- soluble in fats
- produced industrially from 1929 to 80´s
- they were used in many technical fields (color additives, color lakes, plastics, pesticides, cooling liquids in transformers)
- the largest reservoir of them is freshwater and oceans sediments

Polychlorinated biphenyls



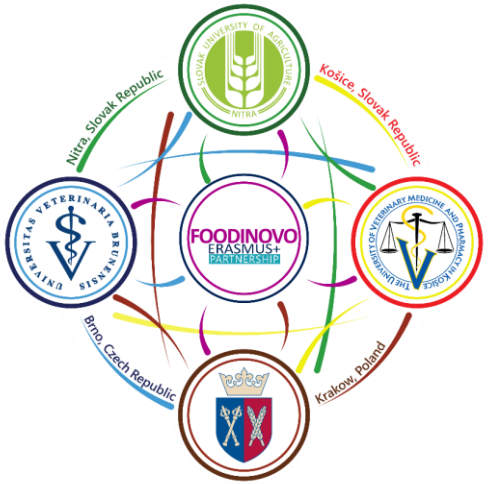
- acute toxicity is low
- symptoms of poisoning include a wide range of pathological manifestations
- carcinogenic effect has not been clearly demonstrated
- PCB source for humans are mainly foods of animal origin

Acrylamide



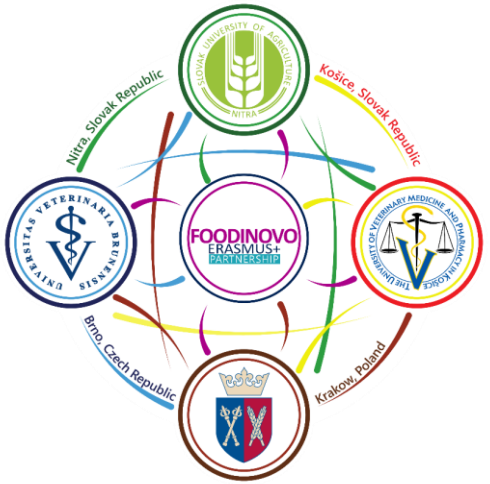
- acrylamide and its analogs have been widely used since the last century for various chemical and environmental applications
- common uses of acrylamide are in the paper, dyes, cosmetics, and toiletry industry
- produced commercially as an intermediate in the production and synthesis of polyacrylamides

Acrylamide



- potentially mutagenic substance
- arises during heating when severe heating foods rich in polysaccharides
- arises from carbohydrates and asparagine, and the generated amount depends on the temperature and length of action
- it recommends limiting heavy roasting at high temperatures and achieving too dark color
- during baking, roasting potatoes, pancakes, bread, pizza, and cakes is better to use fat or use baking paper

Polyaromatic hydrocarbons



- Polycyclic aromatic hydrocarbons (PAHs) or polyarenes constitute a large class of organic compounds (about 10,000 substances)
- Characterized by a structure made up of carbon and hydrogen atoms forming two or more fused aromatic rings
- PAHs are non-polar compounds showing high lipophilic nature
- PAHs are ubiquitous environmental contaminants that are widespread in the air bonded to particulate matter

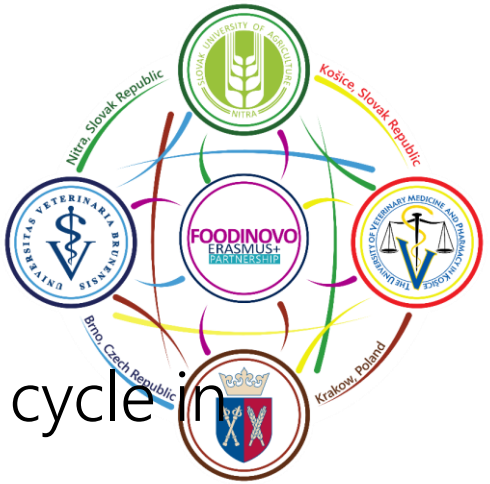
Polyaromatic hydrocarbons

- PAHs show hydrophobic properties, they are also found in water. These compounds are produced during a variety of combustion and pyrolysis processes from anthropogenic and natural sources
- A high amount of PAHs are emitted from processing coal, during incomplete combustion of organic matter (e.g. wood and fossil fuels), from motor vehicle exhaust and cigarettes
- Forest fires, volcanoes, or hydrothermal processes are natural emission sources of PAHs

Benzo[a]pyrene

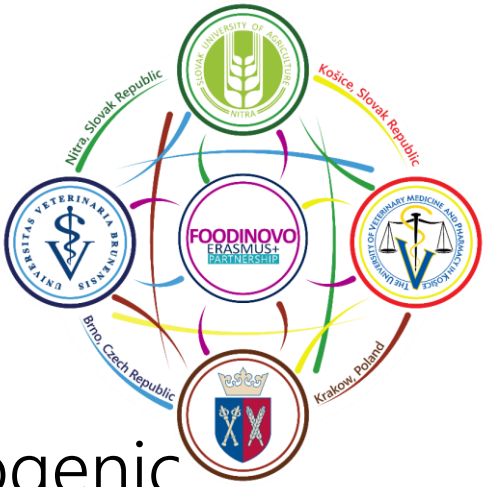
- belongs to the polycyclic aromatic hydrocarbons
- Benzo[a]pyrene (B[a]P), is the most carcinogenic PAHs occurring in food and is frequently used as a marker of the occurrence and effect of carcinogenic PAHs in food
- in animal experiments revealed as a highly carcinogenic substance (is embryotoxic and teratogenic in mice), probably harmful for humans
- BaP is the most known and studied PAH because it is one of the most potent PAH animal carcinogens

Nitrates and nitrites



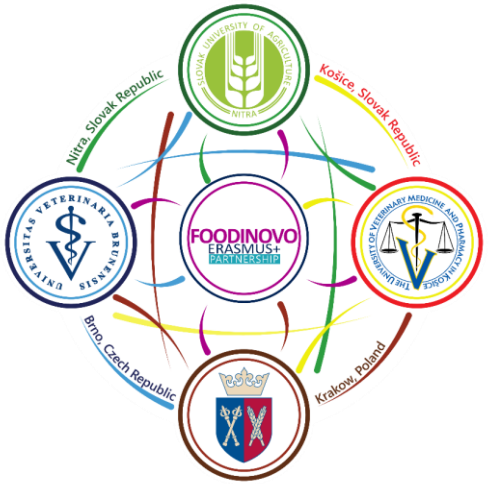
- natural component of many foods as a result of the nitrogen cycle in nature
- in plant foods come nitrates and nitrites from the soil, in food of animal origin come from animal feed and can come from additives
- the main dietary sources of nitrate are vegetables, fruit, processed meats and drinking water
- nitrates are not in normal concentration for adults dangerous (nitrates are by bacteria in the digestive tract reduced to nitrite)
- nitrites that are absorbed into the blood may cause methemoglobinemia (especially in infants)
- nitrites can react with amino acids to form nitrosamines

Nitrosamines



- based on experiments on animals are considered carcinogenic
- are formed in foods during production and storage, and probably are formed in the human stomach
- in foods are formed during the drying and smoking of food through direct heating, technological operations, which are added nitrites or
- nitrates, in the event of contamination of nitrates
- estimates by several investigators suggest that the average daily intake of volatile nitrosamines from foods is approximately 1 microgram/person

Nitrosamines



- Recommendation: limit consumption of smoked and pickled meats and meat products, avoid frying and grilling marinated meats, and dishes containing nitrosamines - if yes - drink fruit juices rich in vitamin C or eat a salad with a dressing of lemon juice

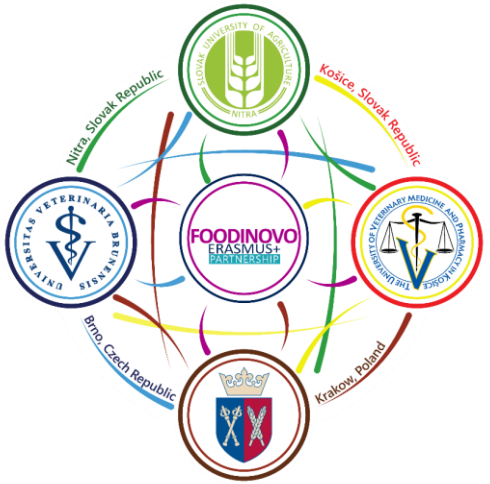
→ Ascorbic acid and sulfur dioxide are used to inhibit nitrosamine formation in foods

Heavy metals

- Heavy metal pollution has spread broadly over the globe, perturbing the environment and posing serious health hazards to humans.
- Soil is the fundamental sustenance for food crops, and it can be greatly perturbed by heavy metals from point sources and non-point sources

  - point sources: energy-intensive industries, such as thermal power plants and coal mines, and chloralkali chemical industries, such as goldmines, smelting, electro-plating, textiles, leather, and e-waste processing
  - non-point sources: soil/sediment erosion, agricultural runoff, and open freight storage

Heavy metals

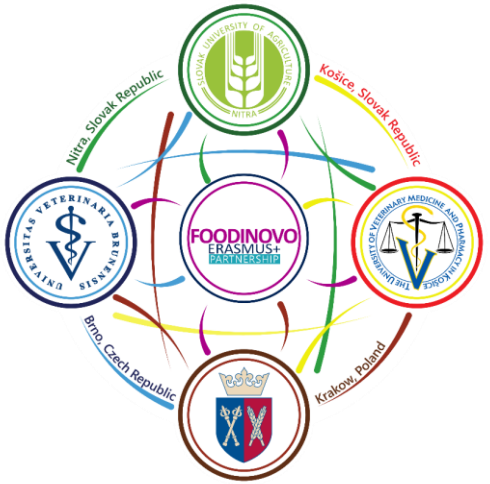


- These elements are getting into the environment and into foods mainly through human activities.
- Food can be contaminated with heavy metals during processing.
- Heavy metals damage the liver, kidneys, and nervous system.
- The most important toxic elements are lead, cadmium, and mercury, to a lesser extent also thallium, tin, and zinc.

Lead

- is ubiquitous element that can contaminate soil, water, and plants including other compartments of the ecosystem and ultimately affect human health
- may also be present in drinking water, another possible source is ceramic pots and dishes with lead glazes and tin cans with solder used for welding
- lead can be removed by washing fruits and vegetables thoroughly.

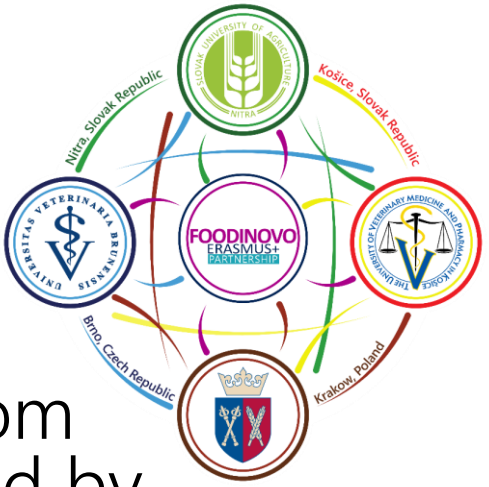
Lead



Toxicity:

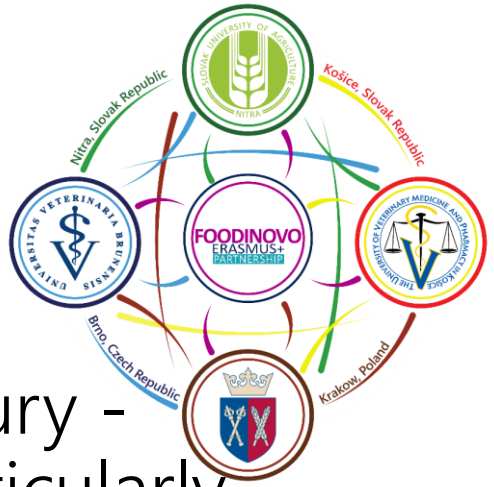
- acute poisoning manifests itself with abdominal pain, constipation and anemia, they are rare.
- as a result of long-term intake, it accumulates in the liver and kidneys and damages them, reduces the amount of hemoglobin in erythrocytes (anemia) and damages the peripheral and central nervous system (movement disorders, brain damage)

Cadmium



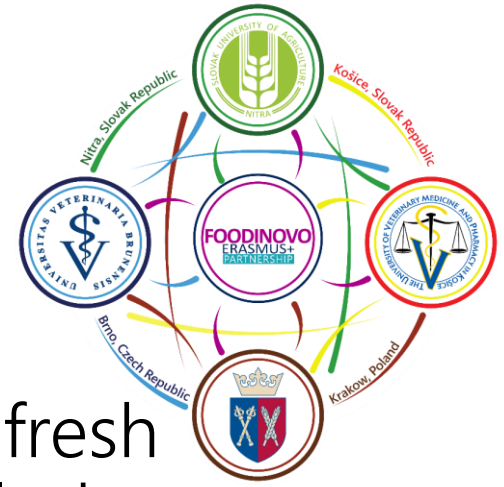
- belongs to the heavy metals, it gets into the environment from industrial waste and fertilizers, from the soil it is well accepted by plants (and therefore it occurs in plant feeds and foods of plant origin)
- increased amounts in wild mushrooms, spinach, celery, poppy seed, and linseed
- from animal foods, the liver and kidneys of cattle and pigs are more burdened with cadmium from cadmium, the high content is in cuttlefish when they are not thoroughly eviscerated and still contain the rest of the viscera
- as with lead, cadmium concentrations have also fallen recently

Mercury



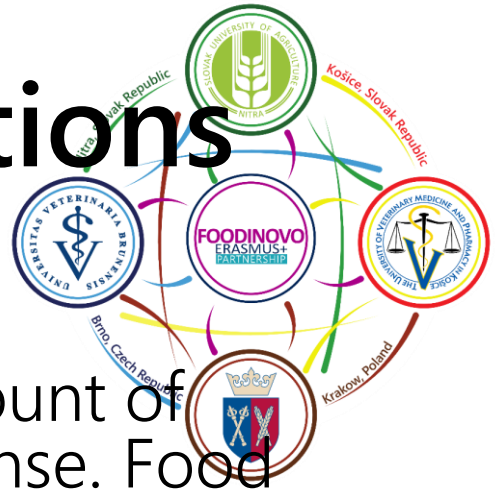
- is a toxic compound (the most toxic form is methylmercury - MeHg) that can contaminate humans through food, particularly via fish consumption.
- in foods can elicit a variety of toxic effects in humans
- high levels of exposure to inorganic mercury are known to cause kidney and liver failure, while much lower levels of exposure to methylmercury (MeHg) are associated with a variety of long-term neurodevelopmental deficits in children and may impair cardiovascular health in adults.
- limits are established by legislation

Additives



- food additives are chemicals added to foods to keep them fresh or to enhance their colour, flavour or texture. They may include food colourings (such as tartrazine or cochineal), flavour enhancers (such as MSG) or a range of preservatives.
- the use of additives is controlled by the EU Regulation
- all additives are evaluated before their approval for safety
- have assigned code to the E-number
- and if necessary having specified limits
- divided according to their function in the product

Substances causing adverse reactions only some individuals



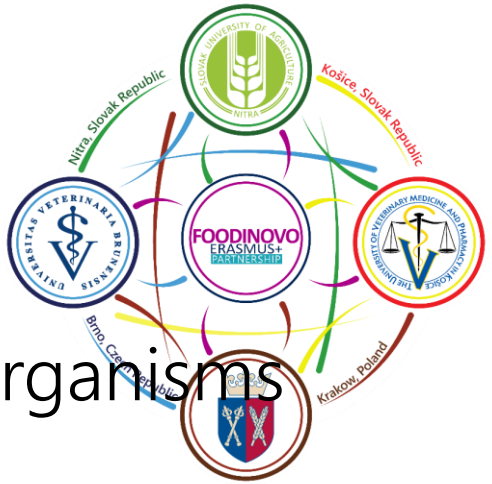
- **A true food allergy** is a disorder in which ingestion of a small amount of food elicits an abnormal immunologically mediated clinical response. Food may cause allergic reactions through several mechanisms
- **Gluten intolerance** is the body's inability to digest or break down the gluten protein found in wheat and certain other grains. Also known as gluten sensitivity, gluten intolerance can range from a mild sensitivity to gluten to full-blown celiac disease.
- **Lactose** intolerance is a condition in which people have symptoms due to the decreased ability to digest lactose, a sugar found in dairy products. Those affected vary in the amount of lactose they can tolerate before symptoms develop. Symptoms may include abdominal pain, bloating, diarrhea, gas, and nausea.

How to prevent chemical contamination and protect yourself from chemical contamination?

- don't use toxic substances in agriculture
- protect the environment
- continuously monitor the maximum levels of contaminants
- observe the rules of hygiene and food choices

BIOLOGICAL HAZARDS

Biological hazards



- health hazards caused by living organisms (ie. by microorganisms and parasites)
- to the human body getting from food and cause diseases (dozens of various diseases)
- regarding potential consequences and the number of people affected are biological hazards most significant, but consumers very underrated them
- microorganisms can indirectly threaten human so that form poison in food (raw materials, semi-finished products) which after consumption of the food or meal cause illness

Foodborne disease

- A disease caused by consuming contaminated food or drink.
- Myriad microbes and toxic substances can contaminate foods.
- There are more than 250 known foodborne diseases.
- The majority are infectious and are caused by:
  - bacteria,
  - viruses,
  - parasites.

Foodborne disease of microbial origin

- infection,
- intoxication

<u>are caused by:</u>

- bacteria,
- viruses,
- their toxins

- incubation period ranges from hours to days

Symptoms

- vomiting,
- fever,
- aches,
- may include diarrhea.

Bouts of vomiting can be repeated with an extended delay in between, because even if infected food was eliminated from the stomach in the first bout, microbes, like bacteria, (if applicable) can pass through the stomach into the intestine and begin to multiply.

Some types of microbes stay in the intestine, some produce a toxin that is absorbed into the bloodstream, and some can directly invade deeper body tissues.

Causes

- Foodborne illness usually arises from improper handling, preparation, or food storage.
- Good hygiene practices before, during, and after food preparation can reduce the chances of contracting an illness.
- There is a consensus in the public health community that regular hand-washing is one of the most effective defenses against the spread of foodborne illness.
- The action of monitoring food to ensure that it will not cause foodborne illness is known as food safety.

What causes biological hazards?

a) Primary contamination

b) The increase hazards during processing

c) Using inefficient technological processes

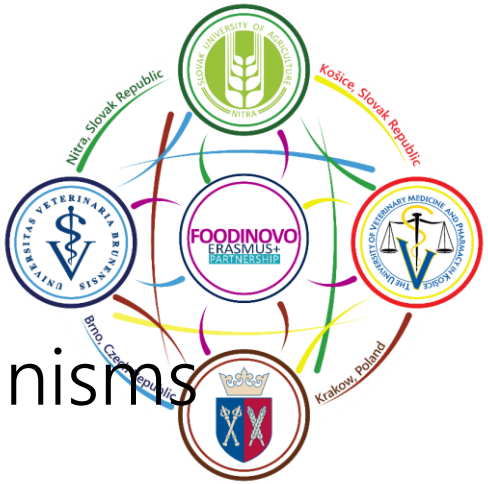
d) Secondary contamination

e) Consumers sensitivity

Bacteria

- the most widespread group of organisms in the world
- most bacteria are harmless to human beings, and many of them are beneficial - are used in food production, but some are dangerous and can cause human disease
- are considered the greatest threat to food safety
  - can directly invade the tissue
  - can produce toxic substances
- according to experts, bacteria are responsible for 30% of confirmed foodborne diseases cause, but to 72% of deaths caused due to consumption of contaminated food

Sources of contamination

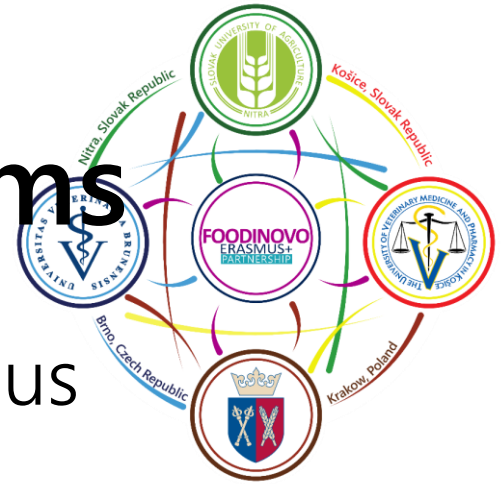


- animals - contamination with faeces or saliva or organisms present in the body of animals
- land - contamination with animal faeces, which can be transferred on crops
- water - contamination by animal excrement which may be transmitted to humans through the consumption or direct watering crops due to contaminated water
- human - infection through unwashed hands after contact with food

Incidence of bacteria

- bacteria are found everywhere, in the air, soil, water, and inside your body and on your skin. They tend to multiply very rapidly under favorable conditions, forming colonies of millions or even billions of organisms within a space as small as a drop of water.
- under optimum conditions, bacteria are capable of multiplying indefinitely at a very rapid rate, so that their numbers may double every 20 min or so.
- some species specialize in settlement environment where other organisms could survive barely

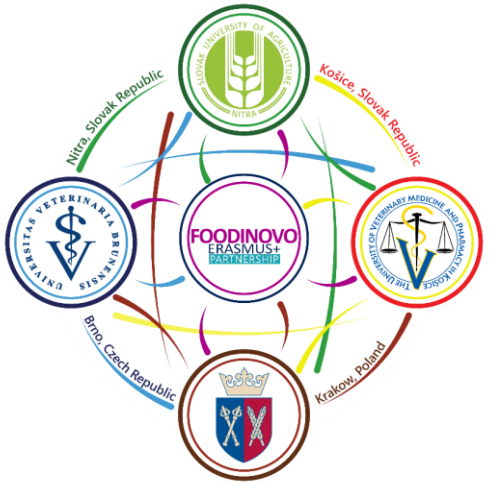
Factors affecting microorganisms



- The growth of microorganisms is influenced by various physical and chemical factors of their environment.
- Physical factors - temperature, pH, osmotic pressure, hydrostatic pressure and radiation.
- Chemical factors - oxygen, carbon, nitrogen, phosphorus, sulphur, etc.

If bacteria suffer from deterioration of living conditions, i.e. by drying, bacteria build up spores.

Classifications of diseases



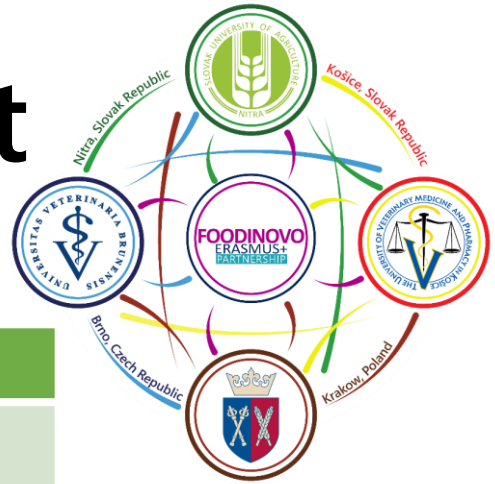
- An anthroponotic disease (anthroponosis) is an infectious disease in which a disease is causing by humans is transferred to other animals.
- The reverse situation, a disease is transmitted from animals to humans, is known as zoonotic. It can also be defined as a human-to-human infection with no animal vector.

Classification by mechanism of infection

Intoxication - bacteria generate toxins that can be classified as either exotoxins or endotoxins. Exotoxins are generated and actively secreted; endotoxins remain part of the bacteria (salmonellosis, campylobacteriosis, listeriosis, yersiniosis, diseases caused by E. coli strains)

Toxinosis is pathogenesis caused by the bacterial toxin alone, not necessarily involving bacterial infection (e.g. when the bacteria have died, but have already produced toxin, which are ingested). It can be caused by Staphylococcus aureus toxins (botulism, staphylococcal enterotoxicosis, B. cereus).

A review of the most important pathogenic microorganisms



	Salmonella	Campylobacter jejuni	Clostridium perfringens
Sources of contamination	The digestive tract of humans and animals	The digestive tract of humans and animals	The digestive tract of humans and animals, soil bacteria
Foods in which there may be present	Meat, poultry, eggs, unpasteurized milk	Meat, poultry, eggs, unpasteurized milk, eggs	Meat preserves
Disease severity	Very frequent occurrence, in some cases fatal (children, the elderly)	Very common in North America and Northern Europe Not very serious	The frequent occurrence, heat resistant spores
Symptoms	Diarrhea, fever, vomiting	Diarrhea (often with bleeding), fever, nausea	Diarrhea, nausea, without fever
Properties	Gram-negative; facultative anaerobic t (°C): 5 <37 <45, pH: 4,5 <6,5-7,5 <9, minimal a_w: 0,95 Maximum concentrations of salts: 8 %	Gram-negative, microaerophilic t (°C): 32 <42–45 < 47 pH: 4.9 <6,5-7,5 < 9,5 minimal a_w: 0,96 – 97 Maximum concentrations of salts: : 2 %	Gram-positive, spore-forming, anaerobic t (°C): 12 <43-45 <50 pH: 4 <6-7 <10 minimal a_w: 0,95 Maximum concentrations of salts: : 6 %

A review of the most important pathogenic microorganisms

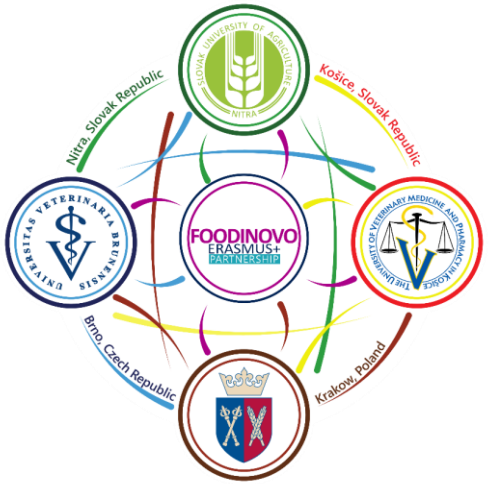
	Yersinia enterocolitica	*Escherichia coli (ETEC)*	*Escherichia coli O157H7 (EHEC)*
Sources of contamination	The digestive tract of humans and animals	The digestive tract of humans and animals	The digestive tract of humans and animals
Foods in which there may be present	Meat and meat products treated undercooked (pork)	Poorly washed vegetable, cheeses	Product from minced meat inadequately cooked
Disease severity	Growing importance	Growing, thermostable and thermolabile toxins	Growing, very dangerous: fatal hemolytic uremic syndrome
Symptoms	Diarrhea, fever, vomiting, abdominal pain (false appendicitis)	Diarrhea, fever, vomiting	Hemorrhagic colitis, kidney failure
Properties	Gram-negative; facultative anaerobic t (°C): 0–1 <32–34 <45 pH: 4,5 <7–8 <9 minimal a_w: 0,95 Maximum concentrations of salts: 5–8 %	Gram-negative; facultative anaerobic t (°C): 4 <30–37<45 pH: 4,4 <7<9.5 minimal a_w: 0.95 Maximum concentrations of salts: 6–8 %	Gram-negative; facultative anaerobic t (°C): 10 <37 <45 pH: 4,4 <7 <9 minimal a_w: 0,95 Maximum concentrations of salts: 6–8 %

A review of the most important pathogenic microorganisms

	Staphylococcus aureus	*Bacillus cereus*	*Clostridium botulinum*
Sources of contamination	Transmitted by humans (skin, mucous membranes - in. nasal cavity, suppurating wounds on the hands, etc.)	Environment: soil bacteria	The digestive tract of humans and animals Environment: soil bacteria
Foods in which there may be present	Ready-to-eat meals, salads, pasta, desserts, etc.	Rice	Ham, tinned meat and vegetable (type E)
Disease severity	Relatively common source of foodborne problems, usually not fatal - "Diseases from banquet"	Produces more toxins, labile toxin causing diarrhea and vomiting, thermostable toxin causing, heat-resistant spores	Quite a rare but very dangerous. Total paralysis which is fatal. Very effective neurotoxin
Symptoms	Vomiting and diarrhea	Vomiting and diarrhea	Dizziness, abnormal vision, paralysis of the larynx, total paralysis, death
Properties	Gram-positive, facultative anaerobic t (°C): 7–11 <37<48 pH: 4 <6–7 <10 minimal a_w: 0,86 Maximum concentrations of salts: 20 %	Gram-positive, facultative anaerobic, spore-forming t (°C): 10 <30 <50 pH: 4,4 <6–7<9,5 minimal a_w: 0,91 Maximum concentrations of salts: 10 %	Gram-positive, anaerobic, spore-forming t (°C): 3,3 <30–37<48 pH: 5 <6,5–7 <9 minimal a_w: 0,94 Maximum concentrations of salts: 10 %

A review of the most important pathogenic microorganisms

	Listeria monocytogenes	*Shigella*	Toxinogenní plísně
Sources of contamination	Ubiquitous in the environment	The digestive tract of humans and animals	Environment
Foods in which there may be present	Pork, cheeses made from unpasteurised milk	Vegetables, hand-prepared dishes	Cereals, oilseeds, fruits and so on.
Disease severity	Very dangerous for immunosuppressed patients (30% mortality), in pregnant causes mutagenic effects	Significant in certain regions (depending on climate). Grows in conditions in which bacteria can not reproduce	
Symptoms	Meningitis, miscarriage	diarrhea, fever	Very diverse effects
Properties	Gram-positive, facultative anaerobic t (°C): 1-4 <37 <45 pH: 4,5<7–7,5 <9 minimal a_w: 0,92 Maximum concentrations of salts: 10 %	Gram-positive, facultative anaerobic t (°C): 5 <35 <50 pH: 4,4 <6–7<9,5 minimal a_w: 0,95 Maximum concentrations of salts: 5–6 %	Anaerobic t (°C): různá 10 °C až 45 °C pH: různá: 1,5 – 11 (spíše kyselé potraviny) minimal a_w: různá: 0,7 – 0,99 Maximum concentrations of salts: 1 až 20 %



INTOXICATION

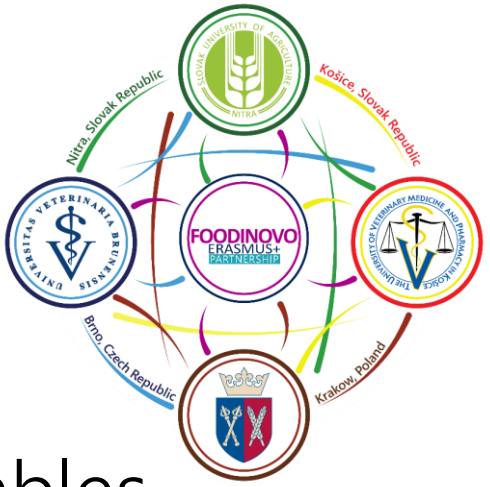
Clostridium botulinum

- produces botulism toxin
- it prevents the release of the neurotransmitter acetylcholine from axon endings at the neuromuscular junction and thus causes flaccid paralysis.
- infection with the bacterium causes the disease botulism
- this toxin is destroyed by heat, light, radiation, and alkaline medium
- in acidic medium and the temperature under 4 ° C is stopped production of the toxin
- suitable substrates for Clostridium are preserves
- high health risks represent fresh food packed in plastic foils with low air exchange, vacuum packaging food with a modified atmosphere, or ready-made dishes prepared by the "sous vide„
- the most important is the prevention

Staphylococcus aureus

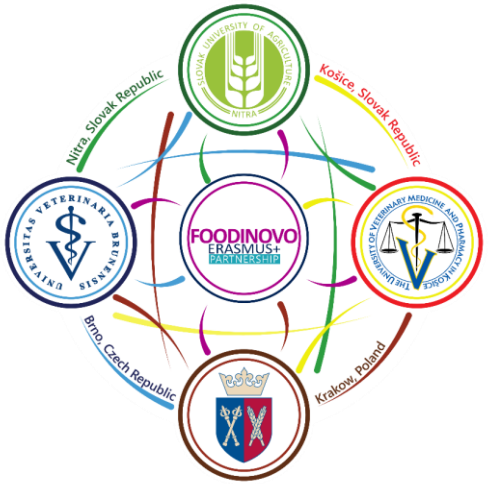
- ubiquitous microorganism causing foodborne diseases, low temperature-resistant, temperatures above 60 °C but does not survive
- poisoning occurs after ingestion of the highly contaminated food where bacteria propagated and produced considerable amounts of toxin
- heat-resistant, temperatures higher than 100 ° C didn´t destroy it
- we know 20 types of staphylococcal toxins
- the disease incubation period is 1-7 hours
- intoxication is accompanied by vomiting, diarrhea, cramps in the abdomen, and headaches, symptoms resolve after 1-2 days

Bacillus cereus



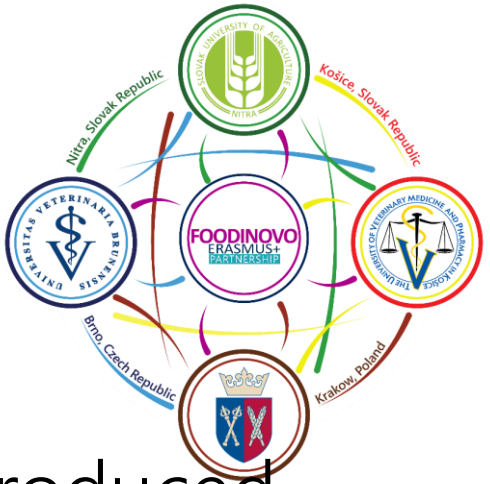
- naturally occurring especially in soil and water,
- food are contaminated mainly raw materials - vegetables, flour, spices, sugar, in the form of resistant spores (survive pasteurization temperatures and food production)
- produces two types of toxins
- most occurrence was detected in rice, raw meat, fish, milk, vegetables, and spices
- Enterotoxin
- Emetic toxin

Yeast and molds



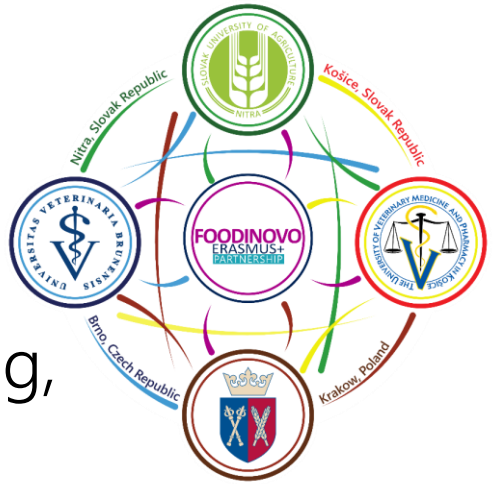
- may cause mycosis and mycotoxicosis
- mycotoxicosis in animals cause allergic reactions, reproduction problems, anorexia, impaired immune system, lower feed utilization, and higher mortality
- humans are known especially those mycotoxicosis: ergot poisoning, cardiac beriberi
- numerous mycotoxins are put into context with the development of cancer
- mycotoxins administered to animals in the diet can also accumulate in meat

Mycotoxins



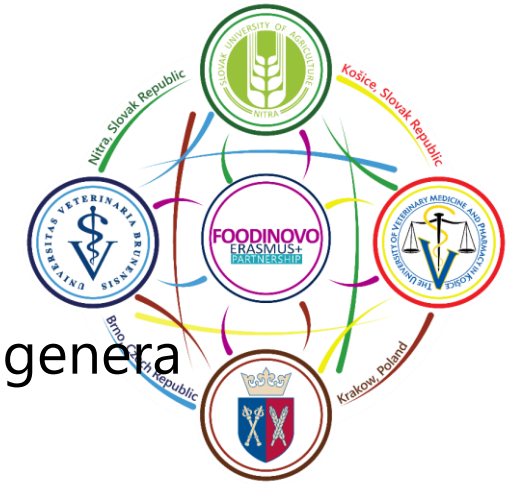
- Secondary metabolites of fungi
- Mycotoxicoses = disease caused by a natural toxin produced by a fungus
- Mycosis = a fungal infection of animals
- Mycotoxins are usually secreted into the substrate, but may also be in the spores
- Mycotoxins are produced by different strains of fungi and each strain can produce more than one mycotoxin

Mycotoxins



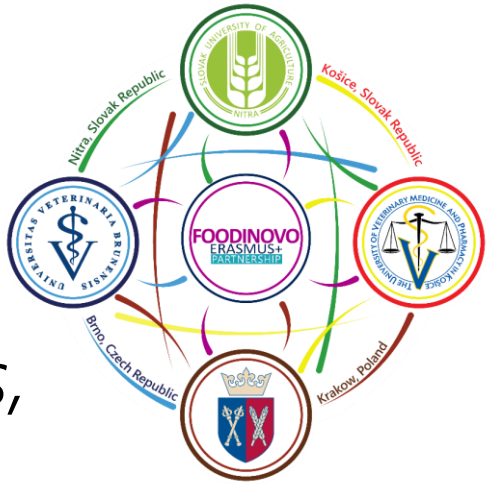
- due to unfavorable temperatures and humidity during harvesting, storage, transportation, and further processing
- almost all mycotoxins damage the liver, and kidneys and negatively affect the immune system, some of which are potentially carcinogenic
- as much as possible you have to protect the food and feed from molds
- we have maximum permitted limits for selected mycotoxins
- food at home which are prone to mildew kept dry and cool, mold growth can be reduced by washing the surfaces with water and vinegar
- don't consume foodstuffs where we can see or feel molds, toxins penetrate into the material without being seen

Mycotoxins



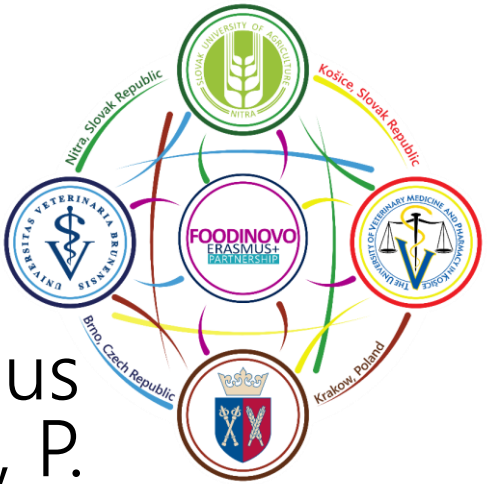
- Mycotoxins are often broken down by major producers, which are from genera
  - *Aspergillus*
  - *Penicillium*
  - *Fusarium*
- Some of the most common mycotoxins include:
  - **aflatoxins**
  - **trichothecenes**
  - **fumonisins**
  - **zearalenone**
  - **ochratoxin**
  - **ergot alkaloids**

Aflatoxins



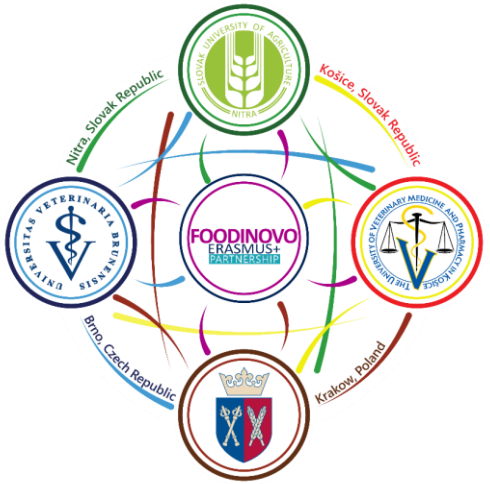
- produced by fungi of the genus Aspergillus (*A. flavus*, *A. nominus*, *A. parasiticus*, *A. niger*)
- described aflatoxins B1, B2, G1 a G2
- corn, peanuts, tree nuts and spices may contain mainly aflatoxin B
- minor representation aflatoxin M1, M2 in milk cows fed with contaminated crops
- important is prevention, toxins can not be disposed of simply treating by high temperatures

Ochratoxins



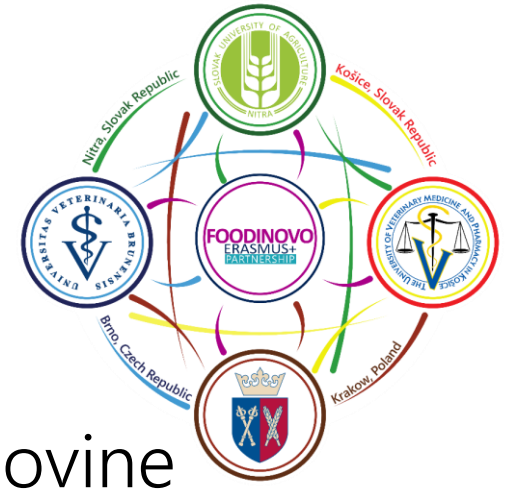
- Ochratoxin A, B and C are produced by fungi of the genus Aspergillus (A. ochraceus) and Penicillium (P. viridicatum, P. verrucosum)
- the most toxic is ochratoxin A, has immunotoxic, teratogenic and carcinogenic effects, also passes into the meat of animals and contaminated animal products can be hazardous to human health
- ochratoxicosis causes a significant irritation of the digestive tract and to the development of acute gastroenteritis
- ruminants are resistant against ochratoxins

Patulin



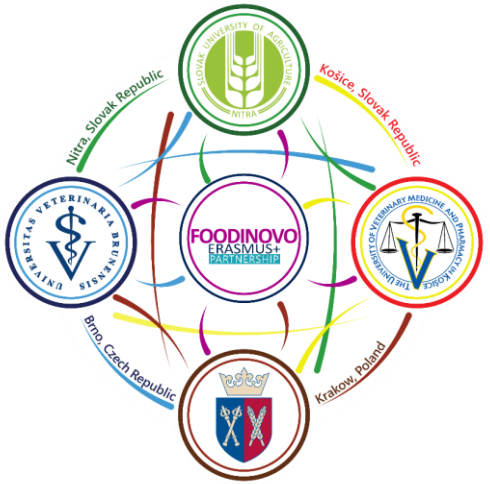
- toxin is mainly produced by *Penicillium expansum*, *Penicillium griseofulvum*, *Aspergillus clavatus* and *Byssochlamys nivea*
- the most important source of patulin to humans as apples and apple juice derived from direct compression apples
- in acidic foods, patulin is relatively stable to thermal processes to about 100 °C
- The legislation sets limits of patulin in food

Ergot alkaloids



- lysergic acid derivatives - ergotoxine, ergotamine, ergonovine
- produced by the fungus *Claviceps purpurea*, which are parasitic to other plants (particularly on rye, but also on some turf)
- ergotism of human after eating cereal foods in our conditions, while complying with good agricultural practices and based on current knowledge, is minimal
- more endangered are livestock, e.g. on farms with inadequate fodder base
- ergot alkaloids pass into the milk monogastric animals

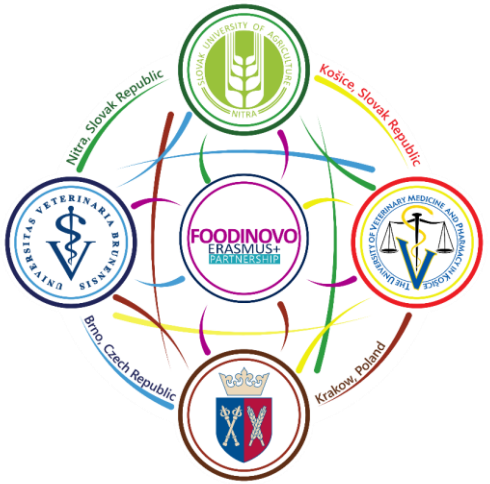
Parasites



Parasites are organisms that derive nourishment and protection from other living organisms known as hosts. When found in food, they can cause diseases in humans. More than 1,000 human cases of food-borne parasitic infections are reported in the European Union each year.

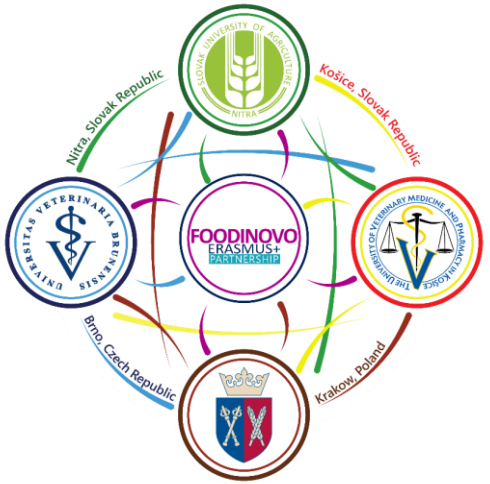
- ectoparasite - colonizes the surface of a host (arthropods)
- endoparasite - lives inside the host (protozoa and helminths)

Parasites



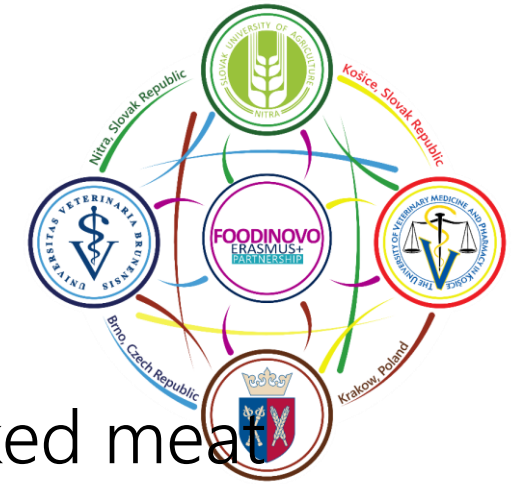
- A parasite is an organism that lives on or in a host organism and gets its food from or at the expense of its host.
- There are three main classes of parasites that can cause disease in humans:
  - protozoa,
  - helminths,
  - ectoparasites.

Parasites



- *Trichinella Spiralis*
- *Taenia saginata*
- *Taenia solium*
- *Toxoplasma gondii*

Trichinellosis

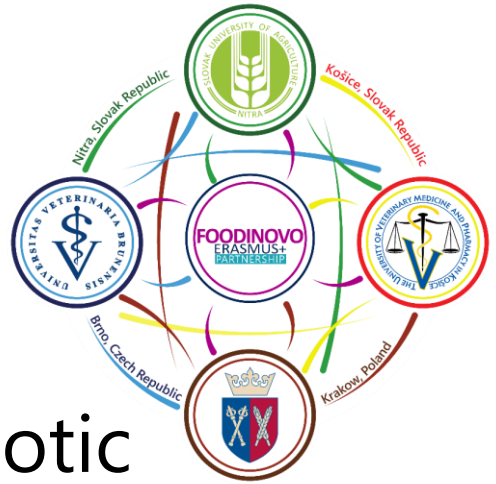


- disease that people can get by eating raw or undercooked meat from animals infected with the microscopic parasite *Trichinella*.
- the first symptoms of trichinellosis are gastrointestinal, usually occurring 1-2 days after a person consumes raw or undercooked meat from a Trichinella-infected animal. These symptoms include: nausea, diarrhea, vomiting, abdominal pain
- the classic trichinellosis symptoms often occur within 2 weeks after eating contaminated meat, and can last up to 8 weeks: muscle pain, fever, swelling of the face, particularly the eyes etc.

Taenia solium

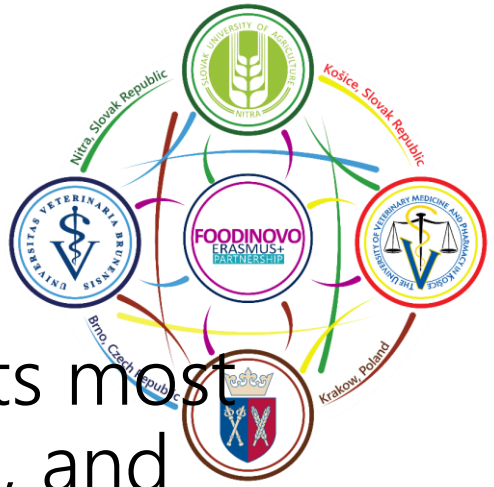
- The pork tapeworm, *Taenia solium*, is the most harmful tapeworm in humans.
- *Taenia solium* infection is acquired either from human feces that contains *Taenia solium* eggs or from uncooked pork which contains larval cysts.
- If larvae are ingested, they mature into adults in the small intestine.
- This infection type is called taeniasis and is often asymptomatic.
- If eggs are ingested, the resulting disease is cysticercosis.
- It gets its name from the larval *Taenia solium* called cysticercus

Taenia saginata



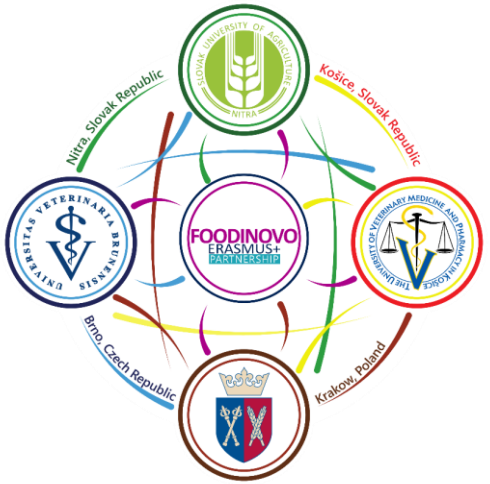
- *Taenia saginata* (*Taeniarhynchus saginatus*), commonly known as the beef tapeworm, is a zoonotic tapeworm.
- It is an intestinal parasite in humans causing taeniasis and cysticercosis in cattle.
- Cattle are the intermediate hosts, where larval development occurs, while humans are definitive hosts harboring adult worms.
- Humans are generally infected as a result of eating raw or undercooked beef which contains the infective larvae, called cysticerci.

Toxoplazma gondii



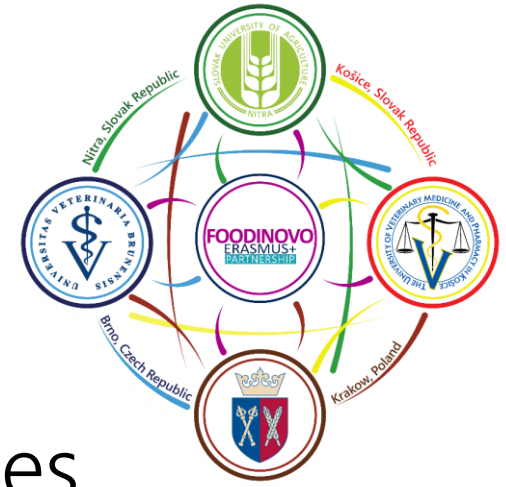
- Toxoplasma gondii is a protozoan parasite that infects most species of warm-blooded animals, including humans, and causes the disease toxoplasmosis.
- Humans can become infected by any of several routes:
- Eating undercooked meat of animals harboring tissue cysts.
  - Consuming food or water contaminated with cat feces or by contaminated environmental samples (such as fecal-contaminated soil or changing the litter box of a pet cat).
  - Blood transfusion or organ transplantation.
  - Transplacentally from mother to fetus.

Anisakis simplex



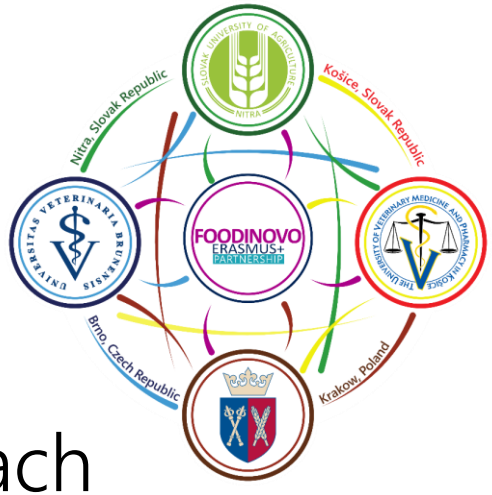
- Anisakis simplex is of much medical importance because of the severe allergic reactions and gastrointestinal symptoms it causes in humans after eating or handling in.
- These symptoms are termed anisakiasis and are especially prevalent in countries where it is common to eat raw or undercooked fish. It has been reported that A. simplex can survive at temperatures of over 65 ・C inside a microwave oven.

Viruses



- Viruses, viroids, and prions are all acellular particles.
- These particles infect living cells and wreak havoc throughout the body.
- They're not made of cells.
- Host necessity - food is excellent passive transmitter
- Highly resistant to low temperatures

Viruses causing gastroenteritis



- Gastroenteritis, also known as infectious diarrhea, is inflammation of the gastrointestinal tract - the stomach and small intestine.
- Symptoms may include diarrhea, vomiting and abdominal pain.
- Fever, lack of energy and dehydration may also occur.
- This typically lasts less than two weeks.
- It is not related to influenza, though it has erroneously been called the "stomach flu".

Norovirus

- Norovirus is the leading cause of gastroenteritis among adults in America, causing greater than 90% of outbreaks.
- These localized epidemics typically occur when groups of people spend time in close physical proximity to each other, such as on cruise ships, in hospitals, or in restaurants.
- People may remain infectious even after their diarrhea has ended.
- Norovirus is the cause of about 10% of cases in children.

Viruses

- Rotavirus, norovirus, adenovirus, and astrovirus are known to cause viral gastroenteritis.
- Rotavirus is the most common cause of gastroenteritis in children and produces similar rates in both the developed and developing world.
- Viruses cause about 70% of episodes of infectious diarrhea in the pediatric age group.
- Rotavirus is a less common cause in adults due to acquired immunity.
- Norovirus is the cause in about 18% of all cases.

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Innovation of the structure and content of study programs profiling food study fields with a view to digitizing teaching

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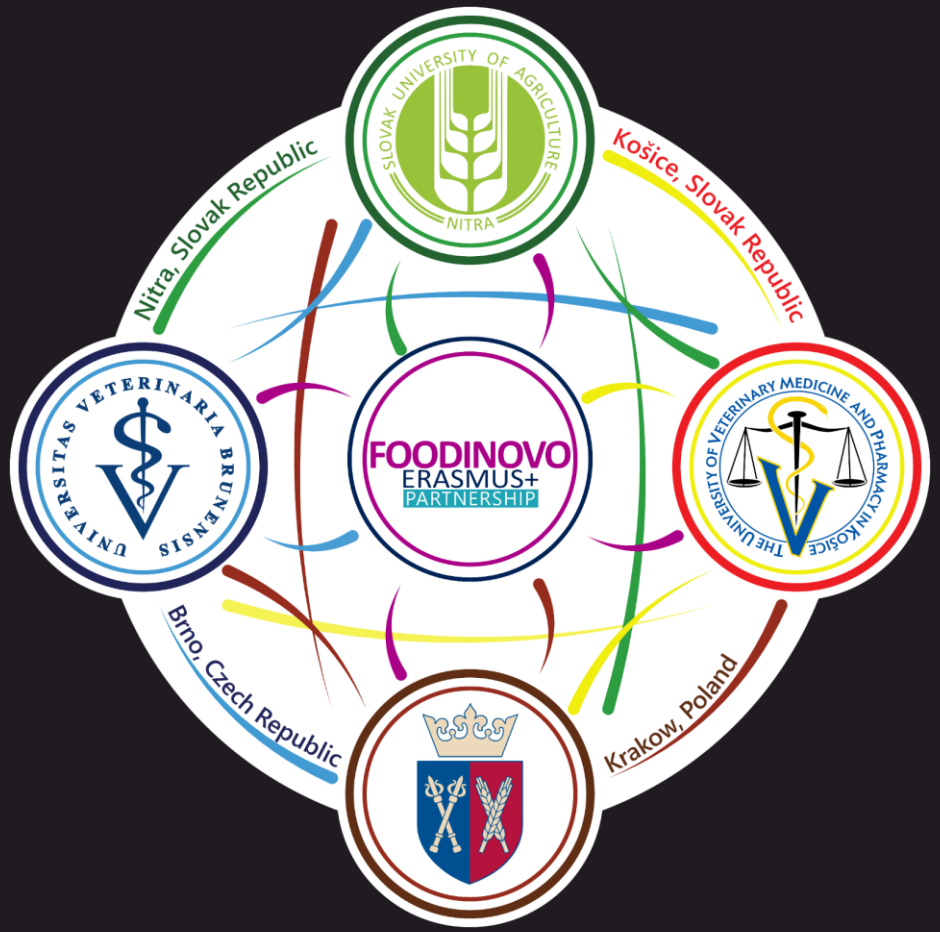

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