Food safety
HACCP
Definition and Role of Food Safety

• Practice of ensuring that foods cause no harm to the consumer
• Three basic operations:
  1. Protection of the food supply from harmful contamination.
  2. Prevention of the development and spread of harmful contamination.
  3. Effective removal of contamination and contaminants.
• **Food safety hazard:** any factor present in food that has the potential to cause harm to the consumer, either by causing illness or injury.
  – Biological
  – Chemical
  – Physical
Food safety (EU)

• „FROM THE FARM TO THE FORK”
• EU food strategy
  – Legislation on the safety of food and animal feed
  – Sound scientific advice on which to base decisions
  – Enforcement and control
• Special measures – consumer protection
  – Use of pesticides, food supplements, colourings, antibiotics, hormones
  – Adding vitamins, minerals, etc.
  – Products in contact with foodstuffs (e.g. plastic packaging)
  – Labelling rules
„From farm to the fork” policy

• Covering all sectors of the food chain, including feed production, primary production, food processing, storage, transport and retail sale.

• Consumers must also recognize that they are responsible for the proper storage, handling and cooking of food.

• Feed manufacturers, farmers and food operators have the primary responsibility for food safety;
  – competent authorities monitor and enforce this responsibility through the operation of national surveillance and control systems.
Main sources of food contaminations

- Environment
- Agriculture
- Animal husbandry
- Raw Storage
- Processing
- Packaging
- Food preparation
- Storage
Classification of foodborne diseases and etiological agents

Food-related diseases

1. Diet-related noncommunicable diseases
   (obesity, cancer, under/malnutrition, CV diseases)

2. Food allergy and intolerance

3. Food-borne diseases
   (infection, intoxication)
Food-borne diseases

**Definition:**
Any disease of an *infectious or toxic nature* caused by or thought to be caused by the *consumption of food or water*.

It can be:

- **Infection**
  - Salmonellosis,
  - Campylobacter enteritis
  - Listeriosis
  - ...

- **Intoxication**
  - Botulism
  - Staphylococcal intoxication
  - *B. cereus* intoxication
Factors contributing to outbreaks of food-borne illness

- Preparation too far in advance
- Storage at ambient temperature
- Inadequate cooling
- Contaminated processed food
- Undercooking
- Contaminated canned food
- Inadequate thawing
- Cross contamination
- Food consumed raw
- Improper warm handling
- Infected food handlers
- Use of left overs
- Extra large quantities prepared
Most important factors that affect microbial growth

- availability of nutrients
- temperature
- acidity/pH
- available water
- oxygen (air)
- antimicrobial agents
- time
Contamination: how do microorganisms get into food?
Food-borne infections

**Infectious dose:** sufficient number of cells to cause illness varies between organisms - approx. $10^5$-$10^6$ cells/g.

**Effect:** invasive - non-invasive

**Susceptibility:** general (YOPI group !!! (Young, Old, Pregnant, Immunocompromised))

**Incubation period:** varies between organisms and diseases
What are the most common pathogens?

• *Campylobacter*
• *Salmonella*
• *E. coli O157:H7*
• calicivirus, also known as the Norwalk-like viruses.
## NUMBER OF REPORTED FOOD INFECTIONS, HUNGARY

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<tr>
<td>Enteritis infectiosa</td>
<td>35600</td>
<td>29878</td>
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<tr>
<td>Campylobacteriosis</td>
<td>5536</td>
<td>6583</td>
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<tr>
<td>Salmonellosis</td>
<td>7166</td>
<td>6029</td>
<td>5961</td>
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<td>Shigellosis</td>
<td>78</td>
<td>42</td>
<td>101</td>
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<tr>
<td>Dyspepsia coli</td>
<td>37</td>
<td>4</td>
<td>17</td>
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<tr>
<td>Yersiniosis</td>
<td>40</td>
<td>51</td>
<td>89</td>
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</tbody>
</table>
Salmonellosis
Salmonellosis

- **Transmission**: ingestion of viable organism from food from infected animals, food contaminated with feces (human or animal). Primarily foods of animal origin: eggs, poultry, meat, milk.
Campylobacter enteritis

- **Source**: intestinal tract of domestic and wild animals, foods (raw milk and poultry).
- Leading cause of bacterial food-borne gastroenteritis in the United States (U.S.) and worldwide.

Calicivirus or Norwalk-like virus

- extremely common cause of foodborne illness,
- rarely diagnosed, because the laboratory test is not widely available.

- **Symptoms**: acute gastrointestinal illness, usually with more vomiting than diarrhea, that resolves within two days.

- **Transmission**: unlike many food-borne pathogens that have animal reservoirs, it is believed that Norwalk-like viruses spread primarily from one infected person to another.
  - Infected kitchen workers can contaminate a salad or sandwich as they prepare it, if they have the virus on their hands.
  - Infected fishermen have contaminated oysters as they harvested.
Pregnant women who get listeriosis may only exhibit **flu-like symptoms**, but the illness can cause **miscarriage, stillbirth, premature delivery and infection of the newborn**.

Listeria infection can be prevented by **thoroughly cooking** all meats (even lunchmeat, especially if you’re pregnant), **avoiding raw or unpasturized milk, cheese or juice**, washing vegetables before eating and cleaning hands, knives and cutting boards after dealing with raw meat.
Enteroviral infections

Coxsackie A (herpangina)

Rotavirus infections

Norwalk-virus enteritis

Echo 1, 6, 9 + coxsackie A₄ (Bornholm disease, Pleurodynia)
E. Coli infections

• Most common: 0 157: H7

GERMANY: E. Coli O104:H4 May-July 2011
• spread mostly by contaminated sprouts, and in just a few cases, from close contact with a sick person.
• Europe (Germany, France) and North America
• Shiga toxin
• bloody diarrhea, kidney failure, affect nervous system. The toxin can cause clots to form in small blood vessels. As red blood cells try to pass through the clots they get damaged, causing anemia.
• 4,075 cases (including 908 cases complicated by HUS) and 50 deaths in 16 countries
Microbiological hazard

BACTERIA

original and foreign microflora

facultative pathogens ($10^5$-$10^6$) Str. faecalis, Cl. perfringens, B. cereus, Proteus, Ps aeruginosa, Klebsiella

obligate pathogens Salmonella, Shigella, Campylobacter, enteropathogenic E. coli, Staphylococcus, Cl. botulinum

• FUNGI
  • moulds infesting bulk food (grains, coffee etc.)
  • Aspergillus flavus
    • aflatoxin – peanuts, corn, soya; LD$_{50}$: 0,5-10 mg/kg b.w., liver toxic, carcinogenic
  • Asp. ochraceus
    • ochratoxin – nephrotoxic (Balkan nephropathy), carcinogenic
  • Fusarium : zearalenon – estrogenic effect (corn, grain)
    • carcinogenic?
  • Claviceps purpurea – ergotism (grains)
    • ergot alcaloids: vasoconstriction, gangrene of the limbs (~1 g)
  • Penicillium patulatum: patulin – oedema, carcinogenesis
  • Fusarium: Trichothecenes – grains, corn (hemorrhage)
Chemical hazards – Toxins in plants

- **Lathyrus peas**: cyanogenic amino acids → aminopropionitril → lathyrismus. Symptoms: cramps in the calves, spastic paralysis, paralysed inner organs, mental disorders. (India, 1945)
- **Fava beans**: vicin, convicin → favism (Mediterranean, Iraq, with inherited low G-6-P dehydrogenase); anemia, spleno/hepatomegalia
- **Cyanide**: bitter almonds, other stony fruits (cyanogenic glycosides in the stones) → brandy, sweets
- **Oxalic acid**: spinach, garden sorrel, rhubarb → Ca depletion
- **Solanine**: green parts of potatoes → parasympathetic effect
- **Strumigenic substances**: Brassica spp. (cabbages, kale, cauliflower etc.) incorporation of I$_2$ inhibited
- **Atropine** – honey (no honey for infants)
# Natural toxins

<table>
<thead>
<tr>
<th>Toxins of plants</th>
<th>Sources</th>
</tr>
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<tbody>
<tr>
<td>mycotoxins</td>
<td>toxic mushrooms</td>
</tr>
<tr>
<td>oxalic acids</td>
<td>spinach, rhubarb, sorrel</td>
</tr>
<tr>
<td>atropine</td>
<td>honey</td>
</tr>
<tr>
<td>cyanide</td>
<td>almond</td>
</tr>
<tr>
<td>solanine</td>
<td>potato</td>
</tr>
<tr>
<td>morphine</td>
<td>poppy</td>
</tr>
<tr>
<td>ricine</td>
<td>ricinus</td>
</tr>
<tr>
<td>protease inhibitors</td>
<td>soya</td>
</tr>
<tr>
<td>vicine</td>
<td>Vicia faba – enzimdeficiency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toxins of animals</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>paralititic shell-intoxication</td>
<td>shellfishes</td>
</tr>
<tr>
<td>tetradoxin</td>
<td>fugu</td>
</tr>
</tbody>
</table>
Death cap
(Amanita phalloides)
Gyilkos galóca

Toxin: amanitin, phalloidin

Effect: liver

Collar, sporangium: white, straw
White death cap
*Amanita phalloides*

Initially, gastrointestinal symptoms
- abdominal pain, watery diarrhea, vomiting, dehydration,

After 2-3 days, liver involvement may then occur
- jaundice, diarrhea, delirium, seizures, coma, fulminant hepatic failure and hepatic encephalopathy, renal failure, coagulopathy
**Fly agaric** (Amanita muscaria)
**Toxin:** atropin, scopolamin, ibotenic acid, muscarin, muscason
**Effect:** parasympathetic, hallucinogen, psychotrop
**Panther cap** (*Amanita pantherina*)

**Toxins:** *atropin, skopolamin, muscamol*. **Effect:** parasympathetic, palsy
**What are the tasks of the GP in case of mushroom poisoning?**

- **Suspicion** of mushroom poisoning is aroused by mild to severe gastrointestinal and autonomic symptoms following the ingestion of a meal containing mushrooms.

- **If the meal was eaten within the last few hours** and the patient did not vomit, gastric lavage should be attempted following the administration of activated charcoal or **vomiting should be induced** (ipecac syrup, warm salty water) and laxatives may also be useful – **this also applies to the people who ate from the mushroom but may still be asymptomatic**.

- **Report** food poisoning to the local health care authority.

- **The patient and those who ate from the mushroom should immediately be admitted to a hospital** for close supervision and treatment of symptoms (dehydration, autonomic symptoms, respiratory failure...).

- **Any further consumption of the mushroom is to be prevented without delay.**

- **Samples** of the raw mushroom, the prepared food, vomitus, stomach wash fluid and stool should be sent to the **appropriate health authority’s special laboratory** (in Hungary: National Institute for Food Hygiene & Nutrition)
WARNING
DEATH CAP MUSHROOMS MAY GROW IN
THIS AREA

DO NOT EAT
IF YOU SUSPECT THAT YOU HAVE EATEN A DEATH CAP
MUSHROOM IMMEDIATELY CONTACT THE CASUALTY
DEPARTMENT AT YOUR NEAREST HOSPITAL OR 131126

Canberra Urban Parks & Places
Contact 62072511
Incorporation of whole **raw bitter almonds** is fairly dangerous because, in this case, all of its **hydrocyanic acid is formed** in one's stomach. Serious poisoning is quite rare with adults, but **children may be killed** by just a few bitter almonds.
Potato, which contains the poison glycoalkaloid **solanine** in all its parts but mostly in the blossoms and in the fruit. Its content is extremely high when tubers are unripe or green as a result of incorrect storage but they cannot cause poisoning because **solanin decomposes when boiled**.
Oxalic acids
Nephrotoxic, irritate the gut. In rhubarb, sorrel, spinach…
**Canola** was developed in Canada and its name is a contraction of "Canadian oil, low acid". Natural rapeseed oil contains **erucic acids**, which is mildly toxic to humans in large doses.
Vicia fava

*(vicine and convicine content)*

**Ingestion of fava beans (Vicia faba)** in the fresh, frozen and dried forms have long been held to be able to cause **haemolysis**. It's occurrence is common in countries of the Middle East and the Mediterranean. **Although all persons with favism are glucose-6-phosphate dehydrogenase deficient**, not every glucose-6-phosphate dehydrogenase deficient subject develops haemolysis after ingestion of fava beans.
Chemical hazards – Toxins of animal origin

- **Paralytic shellfish poisoning**: shellfish accumulate saxitoxin from dinoflagellate algae
  Symptoms: Acral paralysis, dysphagia, ataxia, general muscle weakness & paralysis (respiratory → death)

- „**Fugu**” (swellfish, Tetrodon rubripes; Japan, China) tetrodotoxin, acting on Na-channels

**Biogenic amines**

- histamine
- tyramine („cheese reaction”) 
- serotonin
  monoaminergic effects
Fugu fish - tetradotoxin
Shellfish poisoning is caused by a group of toxins found in planktonic algae (in most cases dinoflagellates) upon which the shellfish feed. The toxins are accumulated and sometimes metabolized by the shellfish. The 20 toxins responsible for paralytic shellfish poisonings (PSP) are all derivates of saxitoxin.
Food additives

- not normally consumed as a food in itself (used as an ingredient of a food), but is intentionally added to achieve a specific technological function.
- are used
  - to preserve the nutritional quality of the food;
  - to provide necessary ingredients or constituents for foods manufactured for groups of consumers having special dietary needs;
  - to enhance the keeping quality or stability of a food or improve its organoleptic properties;
  - to provide aids in manufacture, processing, preparation, treatment, packing, transport or storage of food.

http://www.food.gov.uk/policy-advice/additivesbranch/enumeratorlist#Antioxidants
Food additives

- **Colourings**
  - Today, mainly natural substances, extracts
  - Earlier: many synthetics, mostly banned by now

- **Flavourings and sweeteners**
  - Natural (spices, herbs), nature identical (aromas)
  - NaCl – hypertension
  - Flavor enhancer: Na-glutamate
  - Sweeteners: sugar derivatives (xylitol, sorbitol)
    no energy (saccharine, aspartam, cyclamate etc.)

- **Stabilizers**
  - Natural gelling agents (agar-agar, pectin, alginate)
  - Co – to stabilize beer froth → myocardial hypertrophy

- **Preservatives**
  - Salicylic acid (banned), benzoic acid
  - Sorbic, propionic, citric acid: preferred
  - Nitrite/nitrate – in meat products → nitrosamines (cc.)
  - Sugar, salt – excess intake

- **Antioxidants**
  - Butil-hydroxy-toluol, propil gallate, vitamin C and E
Food contamination of environmental origin (inorganics)

Pollutants ➔ soil, surface waters ➔ plants ➔ humans
 ➔ animals

- Nitrate: N-fertilizers ➔ vegetables (spinach, sorrel, radish)
  methemoglobinemia in infants

- Metals
  - Pb: industry, traffic ➔ plants, surface and absorbed ➔ animals – neurotoxicity
  - Hg: Minamata disease – paralysis, ataxia, tremor, emotional lability, sensory deficits, acute high dose: coma, death
  - Cd: Itai-itai disease – lumbar vertebrae crushed, proteinuria, glaucoma
  - As: sea food, drinking water
Food contamination of environmental origin (organics, isotopes)

- Persistent pesticides (DDT – dichloro-diphenyl trichloroethane)

- PCB, PCDD, PCDF:
  - lipid soluble, persistent, ubiquitous, accumulated and amplified in biota
  - deposited in fat tissue, passing the placenta, present in breast milk
  - Japan (Yusho), Taiwan (Yu-chen): contaminated rice oil
  - Symptoms: brown pigmented skin, nails, lips, chlorine acne, palpebral edema, jaundice, seeing and hearing problems

- Radioactive isotopes
  - atmosphere → soil, plants surface ($^{14}$C, $^{131}$I, $^{90}$Sr, $^{137}$Cs)
  - Chernobyl 1986 - $^{131}$I, $^{134}$Cs, $^{137}$Cs
Technological contaminations

- PAH: smoked, grilled food (also: over-baked/fried)  
  benz-a-pyrene etc.: carcinogens

- Dissolved components (from vessels, packaging etc.)  
  Adulterating effect, health damage

  - Metals
    - Pb lead enamels/glazings (leaching at low pH)
    - Sn – 99.9% – food cans - oxidation
    - Cu, Al – from vessels, barrels – off-taste, toxicity

  - Plastics: machinery, packaging
    - PET – „safe for food”
    - PVC - monomers and plastifier leaching, only cling foil allowed

- Detergents: irritant

- Pesticides, hormones, antibiotics
  - Decay times, residue levels limitations of use
  - Adolescents’ disturbed development
  - AB resistance developing
Helminths and insects

• Helminths
  - sewage irrigation, fertilization with manure (strawberries, lettuce etc.)
  - infested farm and wild swine - trichinelliasis
  - infested swine and cattle - taeniasis

• Insects
  - visiting foodstuffs (flies, cockroaches: transmitting diseases)
  - living in food (moths etc.)
Food allergy

- Allergies → type I, III and IV hypersensitivity

<table>
<thead>
<tr>
<th>Symptoms of IgE-Mediated Food Allergies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutaneous</td>
</tr>
<tr>
<td>Urticaria (hives), eczema, dermatitis,</td>
</tr>
<tr>
<td>pruritus, rash</td>
</tr>
<tr>
<td>Gastrointestinal</td>
</tr>
<tr>
<td>Nausea, vomiting, diarrhea, abdominal</td>
</tr>
<tr>
<td>cramps</td>
</tr>
<tr>
<td>Respiratory</td>
</tr>
<tr>
<td>Asthma, wheezing, rhinitis, bronchospasm</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Anaphylactic shock, hypotension, palatal</td>
</tr>
<tr>
<td>itching, swelling including tongue and</td>
</tr>
<tr>
<td>larynx, methemoglobinemia*</td>
</tr>
</tbody>
</table>

- Influenced by
  - Eating habits
  - Intestinal wall conditions (inflammation: better absorption)
  - Genetic disposition (high IgE and IgG)
Frequent food allergens

- Wheat
- Soybeans
- Peanuts
- Tree Nuts
- Shellfish
Food allergy

Frequent allergens

- **natural**
  - Cow milk ($\alpha$-lactoglobulin, $\gamma$-globulin)
  - eggs (ovomucoid, ovalbumin)
  - fish ($\text{M-allergen}$)
  - peanuts
  - tree nuts

- **additives**
  - Na-glutamate (type I - „Chinese restaurant syndrome“)
    - blush, tearing, headache, thoracic pain

- **contaminations**
  - „Toxic oil syndrome“ Spain, 1981 (fake olive oil; type IV, 20,000 diseased, 300 died), Symptoms: myalgia, pulmonary infiltrates, eosinophilia ($\uparrow$ IgE, Eo)
  - Cross-contaminant food substances (soybeans, peanuts)
Food intolerance and food toxicity

Food intolerance

A general term describing an abnormal physiologic response to an ingested food or food additive; this reaction may be an immunologic, idiosyncratic, metabolic pharmacologic, or toxic response.

Food toxicity (poisoning)

A term used to imply an adverse effect caused by the direct action of a food or food additive on the host recipient without the involvement of immune mechanisms. This type of reaction may involve nonimmune release of chemical mediators. Toxins may be contained within (food or released by microorganisms or parasites contaminating food products.)
## Idiosyncratic Reactions to Foods

<table>
<thead>
<tr>
<th>FOOD</th>
<th>REACTION</th>
<th>MECHANISM</th>
</tr>
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<tbody>
<tr>
<td>Fava beans</td>
<td>Hemolysis, sometimes accompanied by jaundice and hemoglobinuria; also, pallor, fatigue, nausea, dyspnea, fever and chills, abdominal and dorsal pain</td>
<td>Pyramidene aglycones in fava bean cause irreversible oxidation of GSH in G-6-PD-deficient erythrocytes by blocking NADPH supply, resulting in oxidative stress of the erythrocyte and eventual hemolysis</td>
</tr>
<tr>
<td>Chocolate</td>
<td>Migraine headache</td>
<td>Phenylethylamine-related (?)</td>
</tr>
<tr>
<td>Beets</td>
<td>Beetanuria: passage of red urine (often mistaken for hematuria)</td>
<td>Excretion of beetanin in urine after consumption of beets</td>
</tr>
<tr>
<td>Asparagus</td>
<td>Odorous, sulfurous-smelling urine</td>
<td>Autosomal dominant inability to metabolize methanthiol of asparagus and consequent passage of methanthiol in urine</td>
</tr>
<tr>
<td>Red wine</td>
<td>Sneezing, flush, headache, diarrhea, skin itch, shortness of breath</td>
<td>Diminished histamine degradation: deficiency of diamine oxidase (?) Histamines present in wine</td>
</tr>
<tr>
<td>Choline- and carnitine-containing foods</td>
<td>Fish odor syndrome: foul odor of body secretions</td>
<td>Choline and carnitine metabolized to trimethylamine in gut by bacteria, followed by absorption but inability to metabolize to odorless trimethylamine N-oxide</td>
</tr>
<tr>
<td>Lactose intolerance</td>
<td>Abdominal pain, bloating, diarrhea</td>
<td>Lactase deficiency</td>
</tr>
<tr>
<td>Fructose-containing foods</td>
<td>Abdominal pain, vomiting, diarrhea, hypoglycemia</td>
<td>Reduced activity of hepatic aldolase B toward fructose-1-phosphate</td>
</tr>
</tbody>
</table>
What are the GMO?

- Are organisms in which genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination.
What is a Genetically Modified (GM) Food?

- Foods has sequences of DNA from another organism inserted into its genome in order to get a desired phenotype.
- Foods that contain an added gene sequence
- Foods that have a deleted gene sequence
- Animal products from animals fed GM feed
- Products produced by GM organisms
The most desirable agricultural GMO species (2003)

<table>
<thead>
<tr>
<th>GMO field species</th>
<th>Area of field used for GMO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>soybean</td>
<td>55</td>
</tr>
<tr>
<td>rape</td>
<td>16</td>
</tr>
<tr>
<td>cotton</td>
<td>21</td>
</tr>
<tr>
<td>corn</td>
<td>11</td>
</tr>
</tbody>
</table>
Field releases of GMO’s in 2003 by country
Purpose of genetic engineering on plants

• Resistance to diseases and pathogens (bacteria, fungi, viruses, insects…)
• Resistance to novel herbicides
• Protection against abiotic stress – salinity, drought, frost…
• Functional food (cancer protecting tomato, …)
• Improved nutritional value in different food products
• Increased amount of vitamins in products (golden rice – provitamin A)
• Improved aroma, taste and structure of agricultural products
• Improved fiber quality (cotton)
Advantages

- Reduced use of pesticides and herbicides
  - Development of pest resistant crops
  - Reduced herbicide use is better for the environment and reduces costs for farmers
  - less machine cultivation
  - less fuel used -> less emission of CO$_2$ in the atmosphere
Advantages

- Herbicide tolerance
- Insect resistance
- Virus resistance
- Easing of world hunger
  - Development of crops that can be grown in marginal soil
- Reduced strain on nonrenewable resources
  - Development of drought resistant crops
  - Development of salt-tolerant crops
  - Development of crops that make more efficient use of nitrogen and other nutrients
Advantages

🌟 Improved crop quality
   ✧ Development of frost resistant crops
   ✧ Development of disease resistant crops
   ✧ Development of flood resistant crops

🌟 Improved nutritional quality
   ✧ Development of foods designed to meet specific nutritional goals
Disadvantages

• **Gene expression** – Mendel’s law of independent assortment - every gene determinate one characteristics
  – more genes determines one characteristics or more genes determine more characteristics => changing one gene may influence in change of more features

• **Gene dynamics** – during the lifetime of the cell expression of genes may change – one period are active some genes and second period another genes – how to determine exactly expression of a new inserted gene?
Disadvantages

• **Coincidence of genes of different organisms**
  ex: plants, animals, people eating plants-plants are developed defense against herbivores-toxines
  In thousands of years genetically supported neutralisations for undesirable vegetable products developed (in our saliva)

• **Evolution** – selection are always linked with food – too sensitive persons (food) dissapeared from population

• **New food (exotic or GMO)** – increase of alergy

• **Digestion of proteins in intestinum** – procese can stop in the level of undigested particles -> biotic effects???
Disadvantages

• Pollination
  - transfer of pollen and genes by insects even in the area of more km from field with GMO
  - usually inside the species
  - rare between relative species
  - very rare or periodical transfer between different species (weed)
Disadvantages

• Transfer of genes from GMO to weed plant - development of high tolerant weeds

• GM plant become weed – high herbicide tolerance – difficulties with control of growth

• The migration of inserted genes from cultivated plants to wild species

• Artificially created selection pressure could lead to a dominance of GMO
Disadvantages

♦ Insects might develop **resistance** to pesticide-producing GM crops

♦ **Herbicide-tolerant** crops may cross-pollinate weeds, resulting in "superweeds."

♦ There may be unintended **harm to wildlife** and beneficial insects
Political strategy in EU countries

- EU - possibilities for all types of agriculture (classic, ecological, GMO…)
- Consumer must have possibility to choose between GMO and others; declarations on food articles are obligated
- Each EU country can choose freely her own strategy for use of GMO; by consideration of EU Directives

HACCP

• Hazard Analysis and Critical Control Points

• HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product.

• A systematic approach to the identification, evaluation, and control of food safety hazards.
Hazard

Presence of any health-endangering substance in foodstuffs.

- **Biological** (viruses, bacteria, helminths etc.)
- **Physical** (foreign substances – splitters, stones, kernels, hairs, egg shells)
- **Chemical** (toxic substance, generated locally or originating from outside – pesticides etc.)
7 principles of HACCP

Principle 1: Conduct a hazard analysis.

Principle 2: Determine the critical control points (CCPs).

Principle 3: Establish critical limits.

Principle 4: Establish monitoring procedures.

Principle 5: Establish corrective actions.

Principle 6: Establish verification procedures.

Principle 7: Establish record-keeping and documentation procedures.
Concepts in HACCP

Control:
(a) To manage the conditions of an operation to maintain compliance with established criteria. 
(b) The state where correct procedures are being followed and criteria are being met.

Control Measure:
Any action or activity that can be used to prevent, eliminate or reduce a significant hazard.

Control Point:
Any step at which biological, chemical, or physical factors can be controlled.

Corrective Action:
Procedures followed when a deviation occurs.

Criterion:
A requirement on which a judgement or decision can be based.
Concepts in HACCP

Critical Control Point:
A step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

Critical Limit:
A maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food safety hazard.

Deviation:
Failure to meet a critical limit.

HACCP Plan:
The written document which is based upon the principles of HACCP and which delineates the procedures to be followed.
MAKE FOOD SAFETY
What does HACCP cover?

- **HAZARD**
  - **MODIFY THE STEP, PROCESS OR PRODUCT**
    - Yes
    - **IS CONTROL NECESSARY?**
      - No
      - **ARE PREVENTIVE MEASURES IN PLACE?**
        - Yes
        - **DO THE MEASURES REDUCE THE HAZARD?**
          - Yes
          - **COULD HAZARDS REACH UNACCEPTABLE LEVELS?**
            - Yes
            - **WILL A SUBSEQUENT STEP REDUCE OR ELIMINATE THE HAZARD?**
              - Yes
              - **CCP**
              - No
              - **NOT A CCP**
            - No
            - **CCP**
        - No
      - **NOT A CCP**
    - No
  - **NOT A CCP**
ROASTED CHICKEN PIECES: HACCP FLOW CHART

FRESH CHICKEN

- CCP – Refrigerate below 40°F. Transfer to appropriate leak-proof container. Place on bottom shelf of cooler.

RECEIVING

- Using disposable gloves, rinse chicken in cold water. Pop thigh joint and remove the blood sack from backbone. CCP wash and sanitize all equipment used.

CHICKEN BREADING OR SEASONING

- CCP – Keep in dry storage. Once opened, transfer to sealed, plastic container or tightly-sealed in its original “bag in box” container.

STORING

- Bread or season chicken immediately using disposable gloves and place on recommended pans. Store below 40°F until needed.

PREPARATION

- CCP – Sift breading regularly and store in refrigerator if not able to use completely within one hour.

COOKING

- CCP: Cook until chicken reaches internal temp. of 165°F.

HOLDING & SERVING

- Hold chicken in an (HC) holding cabinet or (HT) heated merchandiser. CCP – Hold chicken at 140°F or above for a maximum of 4 hours.
- NOTE: IF YOU ARE GOING TO REWORK PRODUCT, HOLD NO LONGER THAN 2 HOURS. ROTATE PROPERLY – DO NOT MIX NEW WITH OLD.

COOLING

- Chill uncovered in single layer in a blast chiller. CCP – Internal temp. must drop below 40°F in 4 hours.

REHEATING

- CCP – Reheat chicken to 165°F (15 sec.) in less than 2 hours. NOTE: FOR BBQ CHICKEN, COAT CHILLED CHICKEN WITH CHILLED BBQ SAUCE (below 40°F) PRIOR TO HEATING TO 165°F.