Courses held in english – short description:

1. Modeling and optimatization in nutrition

The module consists of the following topics: Introduction to modelling and optimisation. DRI recommendations for specific populations and individuals. Data bases of energy and nutritive contents of foods. Basics of linear programming and simplex algorithm. Recommendations for planning of meals. Paretto optimisation (multiple objective functions such as meal costs, food quality, food preferences etc.). Differences in optimisation based on age groups, gender and energy requirements. Estimation of effects of food processing conditions on nutritive content of food. Model of loss of nutritive value due to heat processing. Review of software support for optimisation, planning and analysis of nutrition. Optimisation and planning of meals, menus and new food products. Introduction to fuzzy logic planning and optimisation.

2. Basic bioinformatics

Genomics, proteomics and bioinformatics are parts of molecular biology and information technologies that are used for the analysis, understanding and application of genome and proteome sequences of living organisms from bacteria to humans. Bioinformatics comprises computer aided methodology that allows the analysis and unification of data obtained by structural, physiological and genetic research with a goal of finding functions of genes and their protein products. The results obtained using these disciplines can be used for the development of novel strategies for the recognition of useful novel genes, potential biological targets, for the understanding of their behaviour in the development of novel therapeutic products. This module will ensure the theoretical and practical education in the field of computational biology. It is important to emphasise that worldwide consultant organisations that are involved in the acquisition and analysis of data as well as in anticipating the job structures for the XXI century, estimate that two of ten hottest jobs in the future will be "gene programmers" and "data miners" both based on bioinformatics.

3. Food packaging

This module consists of the following topics: Definitions. Function of packaging. Broad classification of packaging materials: wood; paper/board; textiles; metals; glass; ceramics; porcelain; plastics; biodegradable plastics; edible films and coatings; laminates; others. Packaging forms and shapes. Packaging manufacture (Injection moulding, Pressing, Blowing, Extrusion, Calendering, Blow molding, two and three pieces cans production, glass and plastic bottles). Closures. Physico-chemical and mechanical characteristics of packaging materials. Packaging systems. Packaging methods: aseptic, vacuum, modified/controlled, active and intelligent packaging, susceptors. Packaging machinery. Food/packaging interaction (corrosion, migration, gas and water vapour permeability). Handling and transportation. Types of transport. Warehouses. Package regulations (EU legislation). Package and Environment (package waste and recycling).

4. Nutriogenomics

The aim of the course is to introduce students to the basics of various "omics" used to decipher interaction between our genetic makeup and environmental factors, including nutrients, and to explain technology behind it. The course will also cover basic concepts of genetics and evolution as well as newer concepts involved in controlling our genetic makeup and health such as epigenome and microbiome.
Nutrigenomics focuses on the effects of nutrients on the human genome, proteome, and metabolome. It is applying methods of genomics, transcriptomics, proteomics and metabolomics to human nutrition in order to understand the relationship between nutrition, inheritance and health. Nutrigenomics has been defined as the application of highthroughput genomic tools in nutrition research. The term high throughput tools in nutrigenomics refers to genetic tools that enable literally millions of genetic screening tests to be conducted at a single time. When such high throughput screening is applied in nutrition research, it allows the examination of how nutrients affect thousands of genes present in the human genome. Nutrigenomics involves the characterisation of gene products and the physiological function and interactions of these products. This includes how nutrients affect the activation of specific genes and how these proteins in turn affect the response to nutrients.

5. Ecogenetics studies

In this module students will acquire knowledge about variety of genotoxic agents, their presence in environment and work place. Also, they will get knowledge about mechanisms of toxicity, processess of biotransformation, genotoxicity evaluation methods, test systems, law regulatives and molecular methods currently applied for environment protection.

6. Genetics of industrial organisms

The genetic diversity of microorganisms as a resource for natural product plays a major role in the development of new biocatalysts and drugs. The novel cultivation technologies and, more importantly, gene mining by direct cloning of soil or sea DNA and screening of the resulting complex metagenomic libraries increase the discovery rate of new biomolecules and minimize the reevaluation of already known natural products.
Students learn the techniques of keeping, maintaining and revitalizing industrial microorganisms and culture cells. Genetic nomenclature and the ways of obtaining experimental and industrial organisms are studied in detail. Techniques of improvement of industrial organisms by the methods of mutagenesis, recombination and directed evolution are analyzed. Molecular mechanisms of the cell response to stress, microbial coexistence and quorum signalization are also studied. They also learn about the control, safety measures and potential risks of the cells obtained by genetic engineering.

7. Biochemical analytics

Students will gain the following competences in frame of this module:
Lectures: Chemical and physico-chemical assays of macromolecules: Proteins. Carbohydrates. Lipids. Nucleic acids. Assays of activity and biological effect of

macromolecules. Quantitative analysis using enzymes, examples. Methods for testing integrity of biomacromolecules. Analytical methods applicable in living cells. Cell counting. Immunochemical methods. Quantitative analysis using polymerase chain reaction (PCR). Strategy in following biotechnology processes by biochemical methods.
Practical courses: Different protein assays. Carbohydrate assays. Lipid assays. Nucleic acids assays. Application of enzymic tests for quantitative analysis. RIA. ELISA. Immunoblot. "Real-time" PCR. Implementation of biochemical analytics in biotechnology processes.

8. Powder technology

The module consists of the following topics: Importance of powders in food and pharmaceutical industry. Definition of powder types: cohesive and non-cohesive powders, powder dispersion. Particle characterisation: shape, density, hardness, surface activities, mechanical hardness, volume, moisture, angle of repose. Physical characteristics of powders, Chemical characteristics of powders. Flow properties, caking, agglomeration, segregation.
Sampling –importance of choosing the right method. Particle size distribution and methods of determination (laser particle size analysing etc.). Methods for determination of particle surface. Mechanisms of braking and reducing particle size. Mixing, characterisation of mixtures, mixing devices. Tablets (content, milling, granulation, compression, coating) tableting, encapsulation

9. The fundamentals of bioorganometallic chemistry

On successful completion of the module, students will be able to:

Report the possibilities and benefits of bioorganometallics used in cancer and infectious disease treatment, bioanalysis, molecular recognition, enzyme catalysis and toxicology.

Design and synthesize electroactive bioconjugates of amino acids and carbohydrates with ferrocene.

Evaluate the potential pharmacological and biotechnological application of bioorganometallics.

10. Peptidomimetics and pseudopeptides

On successful completion of the module, students will be able to:

Explain how to overcome the disadvantages of natural peptides (proteolytic instability, polarity, conformational freedom) by using adequately designed mimetics.

Identify peptide and non-peptide structures that mimic the secondary structural element involved in molecular recognition.

Demonstrate conformational analysis of peptidomimetics by using spectroscopic techniques (IR, NMR and CD).

Evaluate the potential pharmacological and biotechnological application of peptidomimetics.

11. Ultrasound in Food Engineering

Ultrasound waves as well as sound waves are mechanical vibrations in a solid or fluid. Ultrasound has been used in a many different technologies for a various industries, and in food engineering it can be divided globally in two main different directions, but also combined in complex research.

More and more in food industry and biotechnology, this utilizable technology is taking place as an analytical tool (low-intensity), or for the material modification before, during and after the processing (hi-intensity).

First, low-intensity ultrasound is diagnostic and non-destructive method that enables reliable data about physicochemical properties of food components and products such as structure, flow rate, thickness, composition, attendance of foreign bodies, texture and particle size, whereas second use of ultrasound (hi-intensity) is used for promoting, modification and changes of physical or chemical properties of foodstuffs such as: filtration, degassing, extraction, drying, homogenisation, emulsification, sterilization-inactivation of m.o., oxidation, enzyme reactions, deblinding-sieving, cleaning, meat tenderization, etc. In most of the reactions with this type of ultrasound changes are permanent.

12. Mechanisam of Evolution

The enigma of genetic evolution in nature or laboratory has been fruitfully explored by using modern molecular techniques. Genotypic and phenotypic diversity has been found in all species at the protein, DNA, and organismal levels. This subject is directed toward studying the evolution of prokaryotic and eukaryotic genomes, including their size, composition, variability and organization. An understanding of the evolutionary process that leads to differences in genomes will shed light on how species themselves differentiate. Students are introduced to the basics of taxonomy and evolutionary systematics as well as to phylogeny and methods of research. Evolutionary inventions and innovations, followed by vertical and horizontal gene transfer are studied.

13. Shelf Life of Packaged Foodstuffs

General Shelf Life Analysis Requirements. Effect of packaging material on product shelf-life. Barrier characteristics of packaging materials. Factors affecting permeation characteristics of packaging materials. Packaging permeation on: gases, water vapour. Effect of packaging methods on product shelf-life. Effects of environmental factors on product shelf-life. Shelf-life protocols: Challenge study; Accelerated shelf life testing; Confirmatory storage study; On-going shelf life monitoring. Food-package interaction (corrosion, migration: global, specific). Packaging and moisture transfer. Permeability and Shelf Life. Water Vapor Permeability of Packaging: Moisture gain; Moisture loss solution. Evaluation of the rate of oxidation of foods packaged in a semipermeable pouch. Oxygen permeation. Packaging laws and regulations (EU). The kinetic model.

Seminars: Shelf-life determination: case studies. Tasks definition and allocation. Seminars presentation by students.