UNIVERSITY OF DEBRECEN

PROGRAM PLAN

DOCTORAL SCHOOL OF NUTRITION AND FOOD SCIENCES

PROGRAM STRUCTURE OF THE DOCOTRAL SCHOOL OF NUTRITION AND FOOD SCIENCES

I. Description of the doctoral school

The Doctoral School explores the methods and procedures of today's new challenges that are closely related to food and nutrition science and thus to public health, through the coordinated study of several interrelated, complementary and mutually dependent research areas. This multifaceted and interdisciplinary task has justified the integration of researchers from different faculties of the University of Debrecen in order to achieve common goals. Accordingly, the fields of medicine and agricultural sciences, which are included in the MAB's discipline classification, are separated from each other by a common bachelor's degree and the doctoral school is divided into two doctoral programmes. Accordingly, at the university level, there are two disciplinary doctoral councils, the Medical Sciences (3.3) and the Agricultural Sciences (4.4), and the training plan is thus divided into two parts.

The aim of the Doctoral Programme in Nutrition is to provide the opportunity to obtain a doctorate in the field of medical sciences:

- in the field of nutrition and health
- health and medicine

Research on nutritional science is of growing importance in the prevention of obesity, diabetes and digestive and vascular diseases. Its link to food quality is a growing part of the world's research in this area. The physiological effects of food, with particular emphasis on clynically exploitable changes in effects. Particular attention will be given to the nutrition therapeutics chapters that exist alongside the drug and food categories, some of which will cover these specific therapeutics, drug-food interactions, and nutritional aspects of specific disease states. The University of Debrecen offers unparalleled opportunities in this field through its cooperation with the Karlovy Vary Region.

head of program: Dr. Zoltán Szilvássy, professor, DSc

The Doctoral Programme in Food Science of the School of Nutrition and Food Science aims to provide the opportunity to obtain a doctoral degree (PhD) in the following research areas:

- Chemistry, biochemistry and biotechnology of food raw materials and foodstuffs;
- food safety, food quality assurance, quality characterisation and quality preservation;
- agroecology, site impact and risk assessment in food production and food supply chains;
- other interdisciplinary fields of knowledge (e.g. site, risk assessment).

Research in sustainable food science and engineering is becoming increasingly important as food and nutrition safety, food and raw material quality, and the application of new methods and processes in the food chain create new challenges. This requires a constantly renewed creative approach to research, from basic to applied research. Our scientific research

programme not only covers the "farm to table" process, but also includes processes in the context of the so-called circular economy (e.g. waste recycling).

Head of program: Dr. Béla Kovács, professor, PhD

The opportunities for PhD students admitted to our doctoral school are complex due to the uniquely broad academic background and training structure of the University of Debrecen. This enables us to provide PhD students admitted to our doctoral school with a high level of knowledge through the offer of compulsory, optional and elective subjects.

Regular members of the doctoral school

Members of the food scineces program:

A list of the food science program members is available on the National Doctoral Database at https://doktori.hu/index.php?menuid=189&lang=HU&tip=TT&diID=221 and on the Doctoral School website at https://elelmiszertudomanyidi.unideb.hu/doktori-iskola-torzstagjai

Members of the nutrition scineces program:

A list of the nutrition science program members is available on the National Doctoral Database at https://doktori.hu/index.php?menuid=189&lang=HU&tip=TT&diID=221 and on the Doctoral School website at https://elelmiszertudomanyidi.unideb.hu/doktori-iskola-torzstagjai

University of Debrecen

Training plan

Doctoral School of Nutrition and Food Sciences

The doctoral program of Nutrition Sciences

Accreditation for the discipline of Medical Sciences in the discipline of Health Sciences 3.3

III. ***Description and details of the Doctoral Program in Nutritional Sciences***

The principles governing the training of doctoral schools in the field of medicine are laid down in the Doctoral Regulations of the Medical Doctoral Council of the University of Debrecen. The Regulations are available on the website of Doctoral School of Nutrition and Food Sciences.

(http://mek.unideb.hu/index.php/hu/), and the www.doktori.hu website.

The primary mission of the Doctoral School of Nutrition and Food Sciences is the training of specialists with scientific degrees, who represent internationally recognised human resources for research and/or higher education of Hungarian food and nutritional sciences; who can conduct and direct basic and applied research, the results of which are relevant to food quality, consumption, dietary culture and may promote to reduce the incidence of illnesses linked to these problems; furthermore, who have the ability to meet the needs of the competitive sector by developing new foods and dietary supplements.

A Doktori Program:
The Doctoral Program:

Field of science:	*medical sciences*
Discipline:	*health sciences*
Awardable doctoral degree:	*"obtained a doctorate (PhD) with summa cum laude, cum laude or rite honor in health sciences"*
Research area:	*public health, preventive medicine, epidemiology, experiential oncology, complex rehabilitation, nutritional sciences, metabolic diseases*
Master degrees on which the doctoral studies are based:	*general medicine, dentist, nutritionist, public health, biology, biotechnology*
Accepted master's degrees:	*general medicine, dentist, pharmacist, clinical laboratory scientist, molecular biology, medical biotechnology*
Head of the Doctoral School	*Dr Zoltán Szilvássy, professor, doctor of the Hungarian Academy of Sciences*

The School Leadership Council oversees the professional activities of the doctoral program, chaired by the Head of the Doctoral School of Nutrition and Food Sciences.

IV. Admission to doctoral school

Two forms of doctoral training are organized by the University of Debrecen: full-time and part-time training. The doctoral course is delivered in Hungarian and English. Admission to the doctoral programme is possible by applying to nationally published topics on

www.doktori.hu, after a successful hearing with the admission committee. (Form of application: Doctoral Regulations of the Medical Doctoral Council)

Educational and scientific activities of institutes and accredited researchers participating in the Medical Doctoral Council's doctoral schools are not homogenous, therefore the students enrolled in the PhD training can have various degrees accordingly (public health, health psychology, complex rehabilitation, nutrition, health services manager, health policy, planning and funding, general medicine, dentistry, pharmacy, biology, molecular biology, chemistry and other relevant degrees). Requirements were defined as to ensure that the admitted doctoral students have proper qualifications and a positive attitude towards research. The most important requirements are a high-quality diploma, a high level of language proficiency, outstanding student scientific research work and a deliberate research design. Applicants' achievements in these fields will be judged according to the uniform scoring system laid down in the doctoral regulations of the Medical Doctoral Council. The scoring system to be used in the admission process can be found in the doctoral regulations of the Doctoral School of Nutrition and Food Sciences.

Along with the applicants, the Doctoral Committee of Medical Sciences at the UD also sets expectations for the supervisors. Besides progressive research activity, the following criteria should be met: indicators of scientific publications 5 years preceding the proposal of the topic have to significantly exceed the requirements, laid down by the doctoral school, for obtaining the doctoral degree (see Doctoral Regulations of Doctoral Committee of Medical Sciences, 15.§). On the other hand, to avoid repeatedly unsuccessful supervisions, the previous proposals of dissertation topics submitted by the supervisor will be evaluated.

V. Organisation of the education

The training is organised by the Doctoral Committee of Medical Sciences involving Doctoral Schools and their Councils. The administrators in charge of the DCMS are centrally in charge of the announcement of the courses, the managing of study matters, the closing of the semesters and the payment of the study grants.The training programme consists of semesters starting on 1 September and 1 February, respectively. PhD students may enrol using the Neptun system at the beginning of each semester during the period as announced in advance, except for the very first semester of the training when they should enrol in person at the PhD Office.

VI. Announcement of courses

The lecturer of the Doctoral School shall complete the course announcement template and then submit the courses to be announced to the Secretary of the Doctoral School. The Secretary of the Doctoral School or the person responsible with the DCMS shall announce such courses already existing in the Neptun system assigned to the Doctoral School. New courses shall be assigned to the Doctoral School and announced by the responsible administrator of the DCMS in the Neptun system.

VII. Conditions of the obtaining of credit points

The lecturer of the Doctoral School shall complete the course announcement template and then submit the courses to be announced to the Secretary of the Doctoral School. The Secretary of the Doctoral School or the person responsible with the DCMS shall announce such courses already existing in the Neptun system assigned to the Doctoral School. New courses shall be assigned to the Doctoral School and announced by the responsible administrator of the DCMS in the Neptun system.

Study requirements are measured by study points (credit points). Credit points are the measurement units of the study, teaching and research work aiming at the completion of the obligations of PhD students in the doctoral training. PhD students shall obtain 30±3 credit points by semester and 240 credit points altogether during the whole training programme. The mandatory number of credits to be obtained in the first four semesters of the medical doctoral training shall be 12.

If the PhD student fails to obtain the required number of credit points due to their fault in a given semester, the Doctoral Committee of the relevant scientific field shall decide on the suspension of the payment of the PhD grant. Should the PhD student fail to make up for their missing credits within a year, the Doctoral Committee of the relevant scientific field may decide on the termination of the student's legal relationship.

In the case of doctoral schools of DCMS, 240 credit points shall be obtained by the students broken down as follows (for a detailed description of each credit type and the criteria of completion, see the relevant points):

training credit points – at least 12 credit points to be obtained during the first four semesters of the training;

research credit points – 27 credit points by semester, and 216 credit points altogether;

dissertation credit points – 6 credit points altogether, in the research and dissertation stage;

credit points to be obtained for other performance – 6 credit points as a maximum (teaching activity, conference presentation, supervisory work, or may be obtained as training credit points).

VII/1. Study (training) credit points

Study (training) credit points may be obtained by the PhD students by learning and reporting at the examination.

The obtaining of the credit points shall be confirmed by the lecturer of the course in the electronic study system based on the examination, test, report etc. required for the course

concerned. The person responsible for the course in the Neptun system shall confirm the completion of the course by granting a 5-grade examination mark.

In the PhD training, no credit points may be obtained by language learning.

The mandatory number of credits to be obtained in the first four semesters shall be 12.

Courses to which the student registered shall be supervised by the supervisor. The student may register to courses organised by other Doctoral Schools of the medical sciences in addition to courses announced by the DSNF if those fit the training orientation of the PhD student.

Courses delivered by the DSNF are listed in Chapter XIV.

VII/2. Teaching credit points

The PhD student may be granted teaching credit points for their teaching activity.

1 credit point shall be granted for a teaching activity of 1 or 2 hours per week for a semester.

For the whole duration of the training, the students may be granted a maximum of 3 credits for teaching activity (Teaching work).

Credit points may be granted for such teaching activity only if that fits the training of the PhD student and contributes to the development of their professional, lecturer's and communication skills.

Credit points for teaching work may be obtained in the third semester of the doctoral training at the earliest.

A maximum of 1 credit points may be obtained for teaching in a single semester.

No credit points may be granted for a teaching activity for which the student is remunerated.

The issue of the pre-degree certificate stating that all course-units have been completed shall be subject to the completion of the Teaching work (1 credit point) course for DSNF PhD students.

Credit points shall be confirmed by the Secretary of the Doctoral School in the Neptun system based on the written confirmation of the head or study administrator of the organisational unit in charge of the educational module concerned.

VII/3. Research credits

The doctoral student shall earn the majority of the 240 credits required in the course of the programme as research credits. The completion of the credits shall be certified on the basis of the written reports submitted by the doctoral student by his or her supervisor in each semester. The reports of the doctoral student shall be sent by the supervisor to the head of the doctoral school after the closing of the semesters.

In the first four semesters of the education (coursework and research stage), 27 credits shall be earned for research work, which can be completed by signing up for the subjects entitled "Research I" to "Research IV".

In the second half of the doctoral education (research and dissertation stage), 27 research credits shall be earned, which can be completed by signing up for the subjects entitled "Research V" to "Research VIII". If the dissertation is submitted and the submission to the procedure is started before the completion of the doctoral education (the end of the eighth semester), the research credits related to the remainder of the semesters shall be awarded by the secretary of the Doctoral Committee (see section 14 (5)).

In the research and dissertation stage students shall earn 6 dissertation credits, which can be completed by signing up for the subjects entitled "Preparation of the dissertation I" and "Preparation of the dissertation II" worth 3 credits each. The student shall complete the subject "Preparation of the dissertation I" in the third semester of the research and dissertation stage at the latest, and the subject "Preparation of the dissertation II" in the fourth semester of the research and dissertation stage at the latest. The completion of the subject shall be certified by the doctoral school, on the report made by the student and the dissertation supervisor. If the dissertation is submitted in the course of the doctoral education, the remainder of the dissertation credits shall be awarded by the secretary of the Doctoral Committee (see section 14 (5)).

The doctoral student in the course of the programme shall earn 216 credits as research credits. The completion of the credits shall be certified on the basis of the written report submitted by the doctoral student approved by his or her supervisor in each semester. The content and formal requirements of the report are laid down in. This certificate is a necessary condition for the successful completion of the semester. A scholarship in the following semester can only be paid based on the successful completion of the semester. The reports of the doctoral student shall be sent by the supervisor to the head of the doctoral school after the closing of the semesters. The content and formal requirements of the report are laid down in Appendix 21 of the Regulations of the Doctoral Committee of Medical Sciences at the University of Debrecen.

During the entire education up to 6 credits may be earned for conference presentations and posters. 3 credits may be given for an international conference presentation, and 2 credits for a presentation in Hungarian. (Symposia of doctoral schools or local events shall not be taken into consideration. Credit points may only be assigned for presentations given de facto by the student.) 2 credit points may be given for first-authored posters in English, and 1 credit point for posters in Hungarian.

The credit points for conference participation shall be determined by the secretary of the doctoral committee, after the request is approved by the head of the competent doctoral school. The request shall also include the documentation of the conference, which shall clearly show the details of the conference and the nature of the presentation. Credits are awarded by the PhD rapporteur.

4 credit points may be earned for participating in the supervision of the work done by a student working on his/her thesis or TDK (Student Competition) paper (4 credits/ student in case of individual supervision and 2 credits/student in case of co-supervision). The credit points - attested by the supervisor of the doctoral student - shall be determined by the secretary of the doctoral committee, and awarded by the PhD rapporteur. The request shall also include the attached completed thesis and/or competition project, and the attestation of the TDK (Student Competition) presentation. (One supervised student may only be counted once, even if he/she has written both a thesis and a competition project.)

For courses completed successfully at another university or in the course of a study abroad programme, the student may earn credits referred to as technical credits that may be considered as completed mandatory course credits. 4 of the mandatorily required 12 course credits (see section (6)) may be earned in this way. The value of the technical credit shall be determined by the secretary of the Doctoral Committee based on the request approved by the head of the competent doctoral school. The request shall also include the attached course documentation, which clearly shows the course topics and the number of contact classes. The credits shall be awarded by the PhD rapporteur.

In addition to participating in organized courses, doctoral students can also earn credits for their teaching activity, if the topic of the taught subject is related to the basic direction of their education. During the six active semesters of the course, students can earn a maximum of 2 credits with teaching activities related to their course. Teaching activity carried out over two semesters is worth 1 credit point. Students can sign up for Teaching Activity I (at the earliest in the 2nd semester of the education) and Teaching Activity II (at the earliest in the 4th semester of the education) subjects announced by the doctoral school in Neptun. The credits shall be certified by the secretary of the doctoral school in the Neptun system upon the written certification issued by the head of the organizational unit responsible for the given teaching module or the person in the unit responsible for education matters.

If a student wishes to submit his/her dissertation before the end of his/her official education and has fulfilled the necessary publication requirements and obtained the study credits, the Doctoral Committee of Medical Sciences can waive the remainder of the research credits.

VIII./1 Mandatory qualifications during the education

The doctoral school considers it important to constantly monitor the academic progress of the doctoral students, and for the individual doctoral students to get to know each other's work. For this reason, every doctoral school of the Doctoral Committee of Medical Sciences organizes an annual PhD symposium, in which the second- and third-year students of the given doctoral school must participate with a presentation. In the presentation, the doctoral

student shall summarize the results of his/her previous year's research work. Although it is not mandatory for first-year students to give a presentation, the doctoral school encourages its youngest members to participate as well.

The doctoral school shall look into the progress of the students (education, research work) at least once a year. The evaluation methods shall be recorded by the doctoral schools in the Quality Assurance Plan. Written documentation is prepared about the results of the evaluation, which is then delivered to the Doctoral Committee of Medical Sciences.

VIII/2. Complex Exam

The complex exam - in accordance with the Act CCIV of 2011 On National Higher Education, 72. paragraph (5) - is organized based on the principles defined by the National Doctoral Committee.
The complex examination is an examination to be completed in the course of the doctoral education, at the end of the fourth semester, as the conclusion of the coursework and research stage and as the condition of the commencement of the research and dissertation stage, which assesses and evaluates the student's progress in the academic and research fields.
Since the student enters the degree-conferment procedure upon the completion of the complex examination, application for the complex examination shall also constitute an application for the degree-conferment procedure.
The condition of admission to the complex examination is that the student has earned at least 90 credits in the "coursework and research stage" of the doctoral education (first four semesters), including all "course credits" prescribed in the educational plan of the doctoral school (with the exception of those preparing individually). If the student has acquired the course credits not in the way specified in the educational plan, the head of the doctoral school may refuse to support the student's application for the complex examination. The number of education (course) credits that are mandatory to be completed in the doctoral education of medical sciences is at least 12.
The complex examination is an examination to be completed in the course of the doctoral education, at the end of the fourth semester, as the conclusion of the coursework and research stage and as the condition of the commencement of the research and dissertation stage, which assesses and evaluates the student's progress in the academic and research fields. The conditions for applying for the complex exam, as well as the general rules for conducting the complex exam, are contained in § 13 of the Doctoral Regulations of the Doctoral Committee of Medical Sciences at the University of Debrecen. The form required for applying for the complex exam is the Appendix 4 of the referenced regulation. The application form is available for download (Word document) on the website of the doctoral school (https://egdi.unideb.hu/hu/documents). The relevant paragraph of the Doctoral Regulations and the application form can also be found in the appendix of this document.
Conducting a complex exam
The complex examination is to be taken publicly, before the board designated by the doctoral committee of the disciplinary area. The examination board shall consist of at least three members, in which the majority are members who do not belong to the same school as the candidate. At least one member is an external member (persons who are not in the employment of the University of Debrecen).

The student may submit a written complaint to the doctoral committee of the disciplinary area against the composition of the board within 8 days, only on the basis of alleged bias or conflict of interest. The complex examination may only be conducted if all three members of the board are present.
Parts of a complex exam:

1) Theoretical part: the examinee's theoretical preparedness is assessed
   In the case of the doctoral schools of medical sciences, the complex examination shall be an oral examination, where the student shall answer the questions in one primary and one secondary subject. To ensure a consistent level of quality, the list of primary subjects approved by the Doctoral Committee of Medical Sciences shall constitute part of the Doctoral Regulations (Appendix 22). The list of major and minor subjects is included in the doctoral school's educational plan and is available on the website of the doctoral school (https://egdi.unideb.hu/hu/documents). For the complex exam, the subjects recommended by the relevant doctoral school must be indicated on the application form. The Doctoral Committee of Medical Sciences decides on the subjects of the complex exam.

2) Dissertation part: In a short (15-minute) presentation, the candidate gives an account of his/her knowledge of the scientific literature, reports on his/her research results, describes his/her research plan for the second phase of the doctoral training, as well as the schedule for the preparation of the dissertation and the publication of the results. After the presentation, the members of the committee shall ask questions about the presented material. The presentation must be prepared with PowerPoint (or other similar presentation programs). *The main content parts of the presentation:* 1. Brief literature review, 2. Main questions of the research work, 3. Methodological foundations, 4. Results so far and expected results, 5. Further plans, schedule.

Evaluation of Complex Examination
The examination board shall evaluate the theoretical and the dissertation parts of the examination separately. The results of the examination shall be announced on the day of the examination. The complex examination shall be considered as successful if the majority of the members of the examination board evaluated both parts of the examination as successful. The doctoral student may re-take an unsuccessful complex examination once, within the same examination period.

IX. Domestic and international educational, scientific, and research relations, part-time training

The Doctoral School encourages and occasionally supports doctoral students' training abroad programs, experience-gaining, and participation in domestic and international conferences.

Doctoral students may participate in study abroad programs based on work programs approved by their supervisors that ensure the validity of the given academic period in the

university's doctoral education program. The duration of the participation in study abroad programmes shall count toward the length of the doctoral education program, the student's status is not suspended, and the stipend from the state scholarship shall be paid to the student. The study abroad program shall require the approval of the doctoral school based on the work program, the dissertation supervisor's recommendation, and the declaration of acceptance by the foreign host institution.

X. Interruption of the doctoral studies

If the student gives notice of the fact that in the next semester, they do not intend to satisfy their academic obligations, or the student fails to register for the next semester, their student status shall be suspended. The total consecutive period for which a student may have suspended status shall not exceed two semesters. The total combined length of time during which a student may have passive status during the doctoral education shall not exceed six semesters. A doctoral committee of the disciplinary area may, at the request of the student, approve a longer suspension of the student status than the limit set in section (1) above, provided that the student is unable to satisfy his/her academic obligations due to giving birth, suffering an accident or illness, or some other unexpected reason beyond his/her control. The student status may only be suspended for the entire semester. No stipend from the state scholarship may be paid during the suspension of the student status.

The student status must be terminated:

- at the end of the fourth semester, if the doctoral student fails to complete the complex examination;
- on the last day of the semester when the doctoral student received the pre-degree certificate (absolutorium);
- at the end of the 14th semester after the student's admission;
- at the end of the eighth semester of the doctoral program for which the student registered.

XI. Conditions for obtaining an absolutorium

Upon the successful completion of the eight semesters of coursework, the doctoral student is given a pre-degree certificate (absolutorium). The absolutorium is the document evidencing that the doctoral student has completed all academic requirements. The condition for obtaining the absolutorium is that the candidate has at least 240 credits. Candidates can obtain these by completing vocational subjects, as already detailed. In addition, the condition for issuing the absolutory certificate is that progress in the research topic is verified by the supervisor every semester (by signing in the index and issuing a grade in the Neptun system). No absolutorium may be issued to doctoral students who have not acquired the necessary 240 credits. In justified cases, the Doctoral Committee of Medical Sciences may waive the acquisition of part of the credits (see 4/B.)

XII. The dissertation evaluation and the public defense

The relevant rules and principles are set out in the Doctoral Regulations of the University of Debrecen, the Doctoral Regulations of the Doctoral Committee of Medical Sciences at the University of Debrecen, and the doctoral school's quality assurance plan and appendices. Students can download all regulations and documents required for the doctoral process directly from the website of the Doctoral School (http://tapltud.unideb.hu/).

XIII. Rules relating to participants in correspondence and individual preparational form of doctoral education

The requirements for correspondence course participants are identical in all respects to the requirements for full-time doctoral students. Those who have significant educational experience and/or scientific results (publications) can be admitted to individual training. The conditions for admission to individual training are determined by the Doctoral Committee of the scientific field. The Doctoral Council of the scientific field also decides whether to waive part of the credits after listening to the opinion of the committee created for this purpose.

XIV. Courses of the nutritional sciences program

Course	lecturer	credit
Compulsory		
Most relevant fields and newest results of nutritional science research	Dr. Szilvássy Zoltán	2
Biometrics	Dr. Huzsvai László	2
General research methods	Dr. Csernoch László	1
Nutrition-related diseases	Dr. Altorjay István	3
compulsorily optional		
Nutrigenomics/nutrigenomics	Dr. Benkő Ilona	3
Cardiovascular aspects of metabolism diseases I.	Dr. Páll Dénes	1
Cardiovascular aspects of metabolism diseases I.	Dr. Páll Dénes	1
Cardiovascular aspects of metabolism diseases I.	Dr. Páll Dénes	1
Nutrition and malignant tumours	Dr. Horváth Zsolt	3
Role of nutrition supplements – their favourable and unfavourable effects	Dr. Juhász Béla	3
Insulin resistance and nutrition I.	Dr. Szilvássy Zoltán	1
Insulin resistance and nutrition II.	Dr. Szilvássy Zoltán	1
Insulin resistance and nutrition III.	Dr. Szilvássy Zoltán	1
Nutrition science and functional food I.	Dr. Szilvássy Zoltán	1
Nutrition science and functional food II.	Dr. Szilvássy Zoltán	1
Nutrition science and functional food III.	Dr. Szilvássy Zoltán	1
optional		
Healthy nutrition and age group specifications	Dr. Gesztelyi Rudolf	2
Interrelations of nutritional factors and preparatory obstructive diseases	Dr. Gesztelyi Rudolf	2
Functioning and control of healthcare systems	Dr. Rurik Imre	2
Favourable and unfavourable interactions between xenobiotics and nutrients	Dr. Benkő Ilona	2
Interrelations of nutrients, nutrition supplements and medicine in the human organism	Dr. Benkő Ilona	2
Food intolerance, food allergy	Dr. Csiki Zoltán	2
Nutrition- physiological role of probiotics	Dr. Csiki Zoltán	2
Development, prevention and treatment of asthma bronchiale and COPD	Dr. Gesztelyi Rudolf	2
Basis and practice of clinical nutrition	Dr. Mária Papp	2
Predictive microbiology	Dr. Baranyi József	2
Microbiomes	Dr. Pfliegler Valter Péter	2
Nutrition Science Journal Club	Dr. Varga Balázs	2

XV. Course schedule of the nutritional science program

name of student:

research supervisor:

type of program: full-time/correspondent (underline)

title of research:

Form	Course	lecturer	semester								kredit	signiture of lecturer
			study- research phase				research-dissertation phase					
			1.	2.	3.	4.	5.	6.	7.	8.		
compulsory	Most relevant fields and newest results of nutritional science research	Dr. Szilvássy Zoltán	x								2	
	Making sense of data in food and life sciences	Dr. Baranyi József		x							2	
	General research methods	Dr. Csernoch László		x							1	
	Nutrition-related diseases	Dr. Altorjay István				x					3	
comp. optional	1.		x	x	x						3	
	2.			x	x	x					3	
optional	1.				x						2	
	2.					x					2	
Other	teaching (max. 3 kr.)										max 6 kr.	
	conference presentation (max 6 kr.)											
	research supervision (max.											

	4 kr.)											
dissertation preparation I.-II.	(2 semesters long)						x	x	x	x	**6**	
course kredits			5	3	4	6	-	-	-	-	**18**	
research kredits			27	27	27	27	27	27	27	27	**216**	
Total											**240**	

date: ……..

signiture of supervisor: ……

XVI. Course topics of the nutritional science program

Most relevant fields and newest results of nutritional science research

Lecturer: Dr. Zoltán Szilvássy

The purpose of teaching the subject, (partial) skills, and (partial) competencies to be mastered:

The subject presents the impact of food technology on preventive medicine.

It covers the following themes: the relationship between food and health, the impact of nutrition in the prevention of disease occurrence, and in preserving health, and the processing technology as preventive medicine. Prevention of diabetes, cardiovascular diseases, cancer, and HIV/AIDS. Effects of special diets planned according to nutritional science and therapeutic recommendations on diseases. Mediterranean diet and health. Asian fermented foods and health.

Mandatory literature:

Food is Prevention, A Case for Integrating Food and Nutrition Interventions into Healthcare (2015) Center for Health Law & Policy Innovation, Harvard Law School

Nutrition for the Ageing Brain, Towards Evidence for an Optimal Diet, Vauzour et. al. (2016) Ageing Research Reviews, Elsevier press, 1-19 pp.

Health Promotion and Aging: Practical Applications for Health Professionals, David Haber (2016) 7th edition, ISBN-13: 978-0826131881, Springer Publishing, New York

Fibrinolytic Enzymes from Medical Mushrooms Lu CL, Chen SN (2012) In: Farraggi E (Ed.) Protein Structure. InTech China pp. 337-363.

Food as Medicine: Functional Food Plants of Africa, Maurice M. Iwu (2016) CRC Press. ISBN 9781498706094

Food Insecurity and Disease: Prevalence, Policy, and Politics (2016) Ed. Areej Hassan. Apple Academic Press. ISBN 9781771884914

Nutrition-related diseases

Lecturer: Dr. István Altorjay

The purpose of teaching the subject, (partial) skills, and (partial) competencies to be mastered:

Review of the wide field of diseases connected to food intake and digestion, the introduction of modern diagnostic laboratory methods, and revision of the new research ways. The course summarizes the following topics: motility abnormalities of the digestive tract, acid-related disorders, the importance of bleedings in the digestive tract, complaints related to insufficient production of digestive enzymes, pancreatic dysfunction, inflammatory conditions of the pancreas, cases of intolerance of nutritional components, real nutritional allergies, gluten-sensitive enteropathy, non-celiac gluten sensitivity, a modern view of inflammatory bowel diseases, the steatosis hepatis, the importance of non-alcoholic steatohepatitis, the occurrence of cancer in the digestive tract, their

relationship with the nutritional customs, tasks, and questions related to the nutrition of operated patients, the importance and conditions of artificial nutrition. Current issues of home parenteral nutrition. Parameters of modern, health-preserving nutrition. State-of-the-art laboratory and imaging diagnostics and treatment of relevant diseases related to the digestive tract.

Mandatory literature:

Varró, Gasztroenterológia, (2011) szerk.: Lonovics J., Nemesánszky E., Simon L., Medicina Könyvkiadó Zrt.,

Food Insecurity and Disease: Prevalence, Policy, and Politics (2016) Ed. Areej Hassan. Apple Academic Press. ISBN 9781771884914

Nutrigenetics, nutrigenomics

Lecturer: Dr. Ilona Benkő

Aim of the course, (partial) skills and (partial) competencies to be mastered:

During the lectures, students can get an insight into the interactions between nutrition and the genome in light of recent scientific literature, on the basis of which the theory and practice of personalized nutrition are beginning to emerge today. Nutrigenomics deals with the effects of nutrients and diets on gene expression, which knowledge can be used to maintain a good quality of life in our lifetime. Nutrigenomics is the science of how we can influence the function of our genes through our diet. Nutrigenomics helps to avoid the manifestation or significantly reduce the symptoms of metabolic diseases by assessing the individual risk of hereditary predisposition. The course covers the following topics: the structure of the human genome, functional genomics, effects of diet and nutrients on genome function, cellular nutrient sensors, role of PPAR receptor family, LXR receptor and its ligands, ChREBP carbohydrate-responsive element-binding protein transcription factor, mTOR – amino acid sensing, nutrients affecting other nuclear receptors, epigenetic effects of nutrients, nutrients influencing DNA methylation, nutrients modifying histone proteins, intergenerational epigenetic inheritance, the relationship between genes and diet, the adaptation of metabolic pathways, gene defects, nutrigenomics of chronic diseases, interactions of diet and nutrients with the genome in obesity, influencing the effects of gene polymorphisms on the development of malignant tumors through diet, chemoprevention with nutrients, influencing common monogenic metabolic diseases through a healthy diet.

Mandatory literature:

Metabolomics and Proteomics, and What to Do with All These 'Omes': Insights from Nutrigenomic Investigations in New Zealand. Barnett M, Young W, Cooney J, Roy N. J Nutrigenet Nutrigenomics. 2014;7(4-6):274-82. Obesity: interactions of genome and nutrients intake. Doo M, Kim Y. Prev Nutr Food Sci. 2015 Mar;20(1):1-7. doi: 10.3746/pnf.2015.20.1.1

Nutrition and malignant neoplastic diseases
Lecturer: Dr. Zsolt Horváth

The purpose of the subject, the (partial) skills to be acquired:
The relationship between eating and drinking habits and the development of cancer. Possibilities of

cancer prevention, with particular reference to vitamins and minerals. The importance of proper nutrition during cancer treatment. The role of nutritional supplements in the prevention and treatment of cancer. Options for the prevention of cachexia. The role of different foods during and after surgical procedures, chemo-, immuno-, radiotherapy, and stem cell therapy. Dietary advice during the treatment of various neoplastic diseases.

Mandatory literature:
Beating Cancer with Nutrition (2005) Patrick Quillin. (4th edition) Nutrition Times Press Inc; ISBN-10: 096383729X
Encyclopedia of Cancer (2011). Manfred Schwab (ed.) Springer Publishing, ISBN978-3-642-16482-8
Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective (2007). World Cancer Research Fund, American Institute for Cancer Research, online:
http://www.aicr.org/assets/docs/pdf/reports/Second_Expert_Report.pdf
Karuse's Food and the Nutrition Care Process (2012). L. Kathleen Mahan, Sylvia Escott-Stump, Janice L. Raymond. (13th edition) Elsevier Saunders, USA, Missouri, Saint Louis ISBN: 978-1-4377-22338
Williams' Essentials of Nutrition and Diet Therapy - Revised Reprint - E-Book. Eleanor Schlenker, Sara Long Roth, Elsevier Mosby, USA, Missouri, Saint Louis. ISBN: 978-0-323-22274-7

The role of dietary supplements, their favorable and adverse effects

Lecturer: Dr. Béla Juhász

The purpose of the subject, the (partial) skills to be acquired:

The market of dietary supplements has shown explosive growth in recent years with more than 5,000 products currently registered in Hungary. In contrast to the previous practice, the release of these products to the market no longer requires a licensing procedure linked to a laboratory test. Since 2004 it is sufficient to register and announce the release to the market at the OÉTI (National Institute of Food and Nutrition Sciences). Accordingly, dietary supplements no longer receive an OÉTI license number, but an OÉTI registration number. The license number carried a kind of guarantee regarding the safety of the product, but in the current system, this advantage is lost. Therefore, more and more products are appearing on the market, the effectiveness and safety of which are neither guaranteed nor proven. With the expansion of the market, consumption habits have also changed: consumers have developed a greater than deserved trust in these products at the expense of genuine pharmaceutical products.

The course aims to review the role of dietary supplements in nutrition, to explain domestic and international regulations, to clarify related definitions, to explore possible favorable and adverse effects, to present dietary supplements that can be recommended in special physiological (e.g. pregnancy, old age, competitive sports) and pathological conditions, and to introduce students to current consumer trends.

The course achieves its goal if, after completing it, the students (at least generally) familiarize themselves with the dietary supplement market and can scientifically evaluate the expected benefits and risk factors of such products. The course is divided as follows: Definition of dietary supplements, domestic and international regulation. The "mechanism of action" of placebo drugs and their importance in medicine. Use of dietary supplements in healthy individuals. Physiological effects of dietary supplements in diseases of major public health importance I. Physiological effects of dietary supplements in diseases of major public health importance II. Physiological effects of dietary

supplements in diseases of major public health importance III.

Mandatory literature:
Nutraceutical and Functional Food Components: Effects of Innovative Processing Techniques, Editor: Charis Galanakis Academic Press,
Gyires K, Fürst Z, Ferdinandy P, Pintér E, Szilvássy Z, Varró A (szerk.): 2016. Farmakológia és klinikai farmakológia. Medicina,
Lugasi A, Horacsek M, Martos É. Étrend-kiegészítők a hazai piacon: az összetevők táplálkozás-élettani értékelése, előnyök és kockázatok; az étrend-kiegészítők szerepe a táplálkozásban. Orv Hetil 2010; 151(48): 1964-75 (DOI: 10.1556/OH.2010.28959)
Biesalski HK, Tinz J. Multivitamin/mineral supplements: Rationale and safety - A systematic review. Nutrition. 2016; pii: S0899-9007(16)00115-5 (DOI: 10.1016/j.nut.2016.02.013)
Rautiainen S, Manson JE, Lichtenstein AH, Sesso HD. Dietary supplements and disease prevention - a global overview. Nat Rev Endocrinol. 2016; 12(7): 407-20 (DOI: 10.1038/nrendo.2016.54)

Insulin resistance and nutrition –

Development and nutritional aspects of obesity and type 2 diabetes mellitus

Lecturer: Dr. Zoltán Szilvássy

The purpose of the subject, (partial) skills and (partial) competencies to be mastered:

During the course, students gain insight into the following topics: the definition, trends, and consequences of obesity, influencing factors in early life, the relationship between diet and physical activity, the effect of exposure to possible toxic foods, the relationship between a sedentary lifestyle and obesity and diabetes, effects of globalization on the disease, strategies to prevent obesity and diabetes.

Literature:

The Glycemic Index: Applications in Practice (2016) Ed. Elena Philippou, CRC Press Michael T. Murray, *Textbook of Natural Medicine,* 2013*, 1320*

http://www.who.int/diabetes/publications/Definition%20and%20diagnosis%20of%20diabetes_new.pdf

Handbook of Nutrition and Food, Third Edition (2016). Carolyn D. Berdanier, Johanna T. Dwyer, David Heber eds.

Sustainable Diets: How Ecological Nutrition Can Transform Consumption and the Food System **(**2017**).** Pamela Mason, Tim Lang, Routledge,. pp. 1 -354.

Joint FAO/WHO Expert Consultation on Carbohydrates in Human Nutrition, World Health Organization

http://apps.who.int/iris/handle/10665/42071

Temple NJ, Nestle M. Population nutrition, health promotion and government policy. (2001) In: Wilson T, Temple NJ, eds.Nutritional Health: Strategies for Diseases Prevention.Totowa, NJ:Humana, pp. 13–29.

Diet, nutrition and the prevention of type 2 diabetes. (2004) NP Steyn et al. Public Health Nutrition: 7(1A), 147–165, http://www.who.int/nutrition/publications/public_health_nut4.pdf

The Diabetes Food and Nutrition Bible : A Complete Guide to Planning, Shopping, Cooking, and Eating. 1st edition (2001) Hope S. Warshaw R.D., Robyn Webb M.S. American Diabetes Association; pp. 1-320.

Nutritional Recommendations for Individuals with Diabetes (2015). Alison Gray, https://www.ncbi.nlm.nih.gov/books/NBK279012/

Articles of the Journal of Diabetes

Nutrition and functional foods

Lecturer: Dr. Zoltán Szilvássy

The purpose of the subject, (partial) skills and (partial) competencies to be mastered:

The aim is to introduce the students to the latest results of modern, evidence-based nutrition science, the current transmission of theoretical knowledge into practice, and the public health significance of guidelines and recommendations. The science of nutrition focuses on the positive and negative effects of diets and food components, and their role in maintaining health and treating diseases. Functional foods and fortified foods serve to preserve health. We discuss certain products' biological effects and significance using them as an example. The course covers the following topics: Basic concepts of nutrition science. Nutrition science methodology. Guidelines for healthy eating. Healthy dietary recommendations. Public health effects of dietary recommendations. Metabolism of biological utilization of nutrients. Food components, toxicology of nutrients. Nutrient requirements, defining guidelines. Nutrients determining the development of infants and children. Nutrients that affect brain development. Dietary factors involved in the prevention of cardiovascular diseases. Prevention and treatment of obesity. The relationship between a healthy diet and type 2 diabetes mellitus. The role of nutrients with antioxidant properties in disease prevention. The role of nutrition in the prevention of osteoporosis. Mechanisms of xenohormesis to enhance stress tolerance. The role of nutrition in the prevention of neurodegenerative diseases (dementia, Alzheimer's disease). The role of nutrition in the prevention of eye diseases (cataracts, retinopathies). The role of dietary fibers in the prevention of diseases. The role of intestinal flora in nutrient supply and nutrient metabolism. Macronutrient deficiencies of global importance. Micronutrient deficiencies of global importance. Comparison of dietary supplements and functional foods. The role of functional foods in health preservation. Examples of functional food products and their biological effects.

Literature

Nutrition in the Prevention and Treatment of Diseases , edited by A.M. Coulston, C.J. Boushey, M.G. Ferruzzi, Elsevier Science and Technology Books, Academic Press, 2013.

Healthy nutrition, the role of age

Lecturer: Dr. Rudolf Gesztelyi

The purpose of the course, (partial) skills and (partial) competences to be mastered:

The aim of the course is to present the digestive system as a functional unit, focusing on the main characteristics of the gastrointestinal ("enteral") mucosa, immune system and nervous system and their age-related changes. The course covers the following topics: Macroscopic and microscopic structure of the gastrointestinal system. Digestive physiology, characteristics in childhood and adulthood. Enzymopathies affecting digestion. Food allergy. Nutritional diseases. The importance of the microbiome (microbiota). The impact of civilization and the modern food industry on the gastrointestinal system.

Compulsory reading:

Ross I. (2022) Nutrition Science: Concepts and Applications. Murphy & Moore Publishing

Relationship of nutritional factors with obstructive airway diseases

Lecturer: Dr. Rudolf Gesztelyi

The purpose of the course, (partial) skills and (partial) competences to be mastered:

The aim of the course is to expand the organ-centered thinking of the students by presenting the mucous membranes of the body as a functional unit. The mucous membranes of the gastrointestinal tract, airways and genitourinary system form a functional network that can give a general response (involving all mucous membranes) to environmental influences (of both infectious and non-infectious origins) that affect a particular mucosal surface, in addition to the local response. The connection between the parts of this functional network is mediated by the mucosal immune system. This immune-mediated communication forms the basis for the frequent co-occurrence of inflammatory diseases in the digestive and respiratory systems. This relationship can be observed not only in individuals with bronchial asthma with an allergic background, who have an increased chance of developing eosinophilic gastrointestinal inflammation, but also in COPD, which condition is often associated with malabsorption and Crohn's disease. Taking the mucosal functional unit into account contributes to a better understanding of inflammatory diseases affecting mucous membranes, and can also help us to identify comorbidities. The course includes the following topics: Pathogenesis and progression of inflammatory airway diseases (asthma bronchiale, COPD) causing lower airway obstruction. The relationship between obstructive airway diseases and gastrointestinal diseases. Cellular and molecular basis of the mucosal functional unit. Nutrients as preventive and risk factors of obstructive airway diseases. Potential new treatment strategies.

Compulsory reading:

Kardos Tamás (szerk.): Tüdőgyógyászat: egyetemi jegyzet. Debreceni Egyetemi Kiadó, 2014.

Tulic MK, Piche T, Verhasselt V. Lung-gut cross-talk: evidence, mechanisms and implications for the mucosal inflammatory diseases. Clin Exp Allergy. 2016; 46 (4): 519-28 (doi: 10.1111/cea.12723)

Marsland BJ, Trompette A, Gollwitzer ES. The Gut-Lung Axis in Respiratory Disease. Ann Am Thorac Soc. 2015; 12 (Suppl 2): S150-6 (doi: 10.1513/AnnalsATS.201503-133AW)

Keely S, Hansbro PM. Lung-gut cross talk: a potential mechanism for intestinal dysfunction in patients with COPD. Chest. 2014; 145 (2): 199-200 (doi: 10.1378/chest.13-2077)

Operation and management of healthcare systems

Lecturer: Dr. Imre Rurik

The purpose of the course, (partial) skills and (partial) competences to be mastered:

Goals and principles of healthcare. Functions of healthcare systems. Financing healthcare systems. Characteristics of the healthcare market. Need, demand and supply in the field of healthcare services. Basic models of healthcare systems. Resource creation and resource allocation in healthcare systems.

Compulsory reading:

esk.sze.hu/downloadmanager/download/nohtml/1/id/12937

Favorable and unfavorable interactions between xenobiotics and nutrients

Lecturer: Dr. Ilona Benkő

The purpose of teaching the subject, the (partial) skills and (partial) competences to be mastered:

Many molecules of the amazing amount of 50-70 tons of food we consume during our lifetime are involved in various molecular interactions. A characteristic of our modern life is the exponential increase in the use of dietary supplements, recreational drugs, and medicines, as well as our exposure to environmental pollutants. We deal with the favorable and unfavorable interactions of the molecules entering our body. The same molecules can influence each other's effects simultaneously or even with a time delay in many places and processes, based on several action mechanisms, e.g. the effect of nutritional status either in the case of preventive interactions or in the course of carcinogenesis. The course contains the following areas: Division of interactions, mechanisms responsible for interactions. Pharmacodynamic drug-food interactions. Pharmacodynamic drug interactions of recreational drugs and alcohol consumption. Pharmacokinetic and multifactorial interactions caused by alcohol consumption. Direct drug-food interactions. Physico-chemical interactions. Interactions in absorption due to changes in gastrointestinal pH. Meal-related medication dosing recommendations. Foods and medicines involved in the "cheese reaction". Other interactions affecting the first pass effect. Grapefruit juice effect. Drug-nutrient interactions in transport processes during distribution. Drug-food-dietary supplement interactions at the level of metabolism I. Drug-food-dietary supplement interactions at the level of metabolism II. Interactions of environmental pollutants and nutrients in metabolism. Nutrient deficiencies caused by drugs. The effect of starvation and malabsorption on the pharmacodynamics and pharmacokinetics of drugs. Effect of obesity on the pharmacodynamics and

pharmacokinetics of drugs. Preventive interactions for the prevention of diseases. Mutagenic and carcinogenic interactions.

Mandatory literature:

Handbook of Drug-Nutrient Interactions,ed by J.I. Boullata, V.T. Armenti, Humana Press, 2010.

Interrelations of nutrients, nutrition supplements and medicine in the human organism

Lecturer: Dr. Ilona Benkő

The purpose of teaching the subject, the (part of) skills and (part of) competencies to be mastered:

The path of drugs and nutrients in the body is determined by the same pharmacokinetic processes. Many interactions may occur throughout the processes of transportation; during absorption, distribution, metabolism, and elimination of drugs. These interactions influence the number of molecules reaching their targets. Nowadays, this intensively developing field of research introduces us to several important synergies. We can also witness that more and more important molecular mechanisms of physiological processes are explored during the research of interactions.

Mandatory literature:

Rang & Dale's Pharmacology, Elsevier, 2018.
Nutrition and Drug Interrelations, Edited by: John N. Hathcock and Julius Coon.: http://www.sciencedirect.com/science/book/9780123325501
Food allergy, food intolerance

Lecturer: Dr Zoltán Csiki

Aim of the course, (partial) skills and (partial) competencies to be mastered:
At the end of the course, the student will be able to differentiate between adverse reactions to food, get information about the modern aspects of nutritional therapy, the complex diagnostics of intolerances and allergies, and the role of diets in symptom relief. The course covers the following topics: Introduction, general concepts – Acute IgE-mediated allergy (anaphylaxis, oral allergy syndrome) – Delayed food allergy (eosinophil oeso-gastritis) – General characteristics of food intolerances – Celiac disease – Histamine intolerance – Lactose, fructose intolerance – Contaminated small bowel syndrome – Microscopic-, collagenous colitis - Probiotics

Mandatory literature:

Barna Mária szerk.: Magyar Táplálékallergia és Táplálékintolerancia Adatbank, Táplálkozási allergiák - Szemere (szerk.), Nékám K.; Springer Hungarica Kiadó Kft., 1994
Polgár Marianne - A *táplálékallergia* aktuális kérdései csecsemő- és gyermekkorban
Metcalfe, Dean D.; Sampson, Hugh A.; Lack, Gideon; (ed.): Food Allergy: Adverse Reaction to Foods and Food Additives

The nutritional and physiological role of probiotics

Lecturer: Dr Zoltán Csiki

Aim of the course, (partial) skills and (partial) competencies to be mastered:
At the end of the course, the student will be able to distinguish between the significant number of probiotic products available in pharmacies, will be informed about the modern aspects of probiotic therapy, the relationship between various diseases and intestinal bacterial flora, and the therapeutic and preventive options. Complex diagnostic and therapeutic algorithms help to choose the right probiotics and to associate synbiotics adequately. The course covers the following topics: Introduction, general concepts – Historical aspects of probiotics – Prebiotics and their role – Lactobacillus – Yeasts – Treatment of gastroenteritis – Probiotics and cytokines, focusing on IL10 – Treatment of allergies, intolerances – Chronic inflammatory diseases and probiotics – Future development directions

Mandatory literature:

Dr. Polgár Marianne, : A bélbaktérium-flóra kialakulása és jelentősége a betegségek megelőzésében és terápiájában
Kneifel, Wolfgang; Salminen, Seppo : Probiotics and Health Claims; John Wiley & Sons, 2011
Otles, Semih; (ed.) Probiotics and Prebiotics in Food, Nutrition and Health; Taylor & Francis, 2013.

Making sense of data in life sciences

(course held in English only)

Subject supervisor and presenter: Dr. József Baranyi

Aim of course, (semi) skills and competence to be acquired:

This one-week-long course is intended primarily for life scientists to demonstrate the proper use of mathematical modelling, computational and statistical techniques to analyse their data, to generate predictions and to make decisions based on the data and the predictions.
The course makes everyday concetps like standard error of estimation, confidence interval, or "statistically significant ($p<0.05$)" understandable. It is to boost the paerticipants' confidence in using such statistical terms in their publications.

Pre-requisites:
For hands-on exercises, participants will need a laptop with Microsoft Excel installed on it. No statistical package will be used; the built-in functions / procedures and the Data Analysis and Solver Add-ins of Excel will be sufficient.

Programme:
Day 1. Basics of Quantification of observations.
- Variables and parameters. Scaling and reparameterizaton.
- Quantification of dissimilarity. Cost function for disagreements.
- Linearization and approximation. Deterministic and random effects. Simulation in Excel.

Day 2. Basics of statistics
- Random variables. Expected value, standard deviation and variance. Random number generation for simulation.
- Approximations of distribution functions; histogram generation. Distributions of transformed random variables.

Day 3. Statistical tests
- Analysis of Variance. T-test, chi-2 test, F-test.
- Confidence intervals and significance levels.

Day 4. Fitting models to data
- The Least Squares Method. Linear regression. Fitting by polynomials.

- Estimates and their standard errors.

Day 5. Test (2 hours, analyzing data in Excel)

Literature:
Helmut F. van Emden: Statistics for Terrified Biologists.
BLACKWELL PUBLISHING, 2008.

Development, prevention and treatment of asthma bronchiale and COPD

Lecturer: Dr. Rudolf Gesztelyi

The purpose of teaching the subject, the (part of) skills and (part of) competences to be mastered:

The main characteristics of obstructive respiratory diseases, including the similarities and differences between asthma bronchiale and COPD, theories of their development, and the main possibilities of their prevention and therapy. The subject covers the following topics: The structure and function of the lungs. The main diseases of the respiratory tract, airway obstruction. Development, course, and differential diagnosis of inflammatory respiratory diseases causing lower airway obstruction. Asthma bronchiale and its treatment. Chronic obstructive pulmonary disease (COPD) and its treatment. Possible new diagnostic and therapeutic strategies.

Mandatory literature:

Kardos Tamás (szerk.): Tüdőgyógyászat: egyetemi jegyzet. Debreceni Egyetemi Kiadó, 2014.

Magyar P, Losonczy G. A pulmonológia kézikönyve. 3.3. Krónikus obstruktív tüdőbetegség – COPD; 3.6. A légutak allergiás eredetű megbetegedései. Medicina, Budapest. 2012.

Gyires K, Fürst Z, Ferdinandy P. Farmakológia és klinikai farmakológia. 24. Az asthma bronchiale és a COPD gyógyszerei. Medicina, Budapest. 2017.

Basics and practice of clinical nutrition

Lecturer: Dr. Mária Papp

The purpose of teaching the subject, the (part of) skills and (part of) competences to be mastered:

The theoretical bases of enteral and parenteral nutrition, the components of nutritional solutions, the method of implementation in clinical practice. The intestine is our largest "immune organ". We are little aware of the importance of this concept in our everyday healing practice. A significant proportion of our patients admitted to the hospital suffer from malnutrition, the latter term indicating both undernourishment and overweight. We need to cure the deficiency state with artificial nutrition. Depending on the disease, we choose the method of nutrient intake. We strive for the enteral route, and we are forced to go the parenteral route. Depending on the patient's nutritional status and energy needs, we choose an enteral formula or a parenteral infusion mixture that can be administered

intravenously. We evaluate the effectiveness of our work by continuously monitoring the anthropometric, laboratory and clinical conditions. My goal is to draw attention to the fact that nutrition is therapy. Its role in healing is indisputable. Rehabilitation of a sick person is cost-effective and in the interest of society as a whole.

Mandatory literature:

Varga Péter: A klinikai táplálás alapjai és gyakorlata Melánia Kiadó Kft. Budapest, 1998.

A. Weimann ESPEN GUIDELINES SURGERY ESPEN Congress Copenhagen 2016: *www.espen.org/presfile/Weimann_2016.pdf*

Making sense of data in life sciences

Journal Club of Nutritional Science

Lecturer: Dr. Balázs Varga

The purpose of teaching the subject, (partial) skills and (partial) competences to be mastered: Presentation and analysis of recent publications in the field of nutritional science.

XVII. Complex examination topics – nutrition science program

Major subjects:

1) The health-preserving role of functional foods
2) Food intolerances, food allergies
3) The role of macronutrients in physiological and pathological processes
4) The role of micronutrients in physiological and pathological processes
5) Metabolic diseases
6) Nutrition and food marketing
7) Epidemiology methodology and nutrition epidemiology
8) Relationship between gastroenterological tumors and nutrition
9) Nutrition-related diseases
10) Obesity and nutrition
11) Food microbiology

Minor subjects:

1) Nutrition science, latest research results
2) Healthy nutrition
3) Nutrition supplements
4) Nutrigenetics, nutrigenomics
5) Toxicology of food ingredients
6) Nutrition and malignant neoplasms
7) The role of food supplements, their positive and negative effects
8) Nutrition science and functional foods
9) Drug nutrient interactions in pharmacokinetic processes
10) The role of probiotics in nutrition and physiology

11) Relationships between the course of chronic inflammatory diseases of the gastrointestinal tract and nutrition
12) Healthy eating, age characteristics
13) The issue of artificial feeding
14) Food hygiene
15) Making sense of data in food and life sciences
16) New results in microbiom research: relevance of co-existing, opportunistic and food-microbes
17) Newest results of food biotechnology

XVIII. Research topics of the Doctoral School

Research areas of the Doctoral Program in nutrition science:

- Gastrointestinal endocrinology
- regulation of gastrointestinal mobility
- regulation of the hypothalamic-duodenal-pancreatic axis
- research on insulin resistance and diabetes
- reflex connections of the gastrointestinal system and the circulatory system
- the question of organic effects in neurogenic obesity
- adaptive mechanisms regulating gastrointestinal secretion and mallitis
- Hedonic and homeostatic appetite regulation

Current, announced and previously announced research topics of the PhD programme in nutrition science can be found in the National Doctoral Committee.
Contact: https://doktori.hu/index.php?menuid=191&lang=HU&di_ID=221

Appendix 1: End-semester research report

Name:
Name and contact details of the dissertation supervisor (email address, telephone number):
Title of the research topic:
Reported period:

I. Short presentation of the work accomplished in the previous semester (up to 500 words):

II. Published or accepted publications:
- authors:
- title:
- journal, page number, year:
- impact factor of the publication:

III. Papers submitted for publication:
- authors:
- title:
- submitted to:

IV. Participation in specialised conferences:
- Name, date and venue of the conference (website of the conference, if available)
- nature of participation: poster paper
- authors of the paper/poster, title of the paper/poster:

V. Title and date (month/year) of reports done in the institute (project report, report on an article, etc):

VI. Study programs:
- Name and address of the host institution:
- Date and duration of the study program:
- Financed by:

Debrecen, …..

…… ……
PhD student dissertation supervisor

Appendix 2: Annual report supplemented by the supervisor's assessment

Name:
Name and contact details of the dissertation supervisor (email address, telephone number):
Title of the research topic:
Reported period:

I. Short presentation of the work accomplished in the previous semester (up to 500 words):

II. Published or accepted publications:
- authors:
- title:
- journal, page number, year:
- impact factor of the publication:

III. Papers submitted for publication:
- authors:
- title:
- submitted to:

IV. Participation in specialised conferences:
- Name, date and venue of the conference (website of the conference, if available)
- nature of participation: poster paper
- authors of the paper/poster, title of the paper/poster:

V. Title and date (month/year) of reports done in the institute (project report, report on an article, etc):

VI. Study programs:
- Name and address of the host institution:
- Date and duration of the study program:
- Financed by:

VII. **Supervisor's assessment:**
- Status of the research work for dissertation:
- Plans for the future:
- Scientific presentations:
- Scientific publications:

Debrecen, …..

…… ……
PhD student dissertation supervisor

……..
Head of the doctoral school

Appendix 3: Certification of teaching activity

I …….. certify the teaching activity of ……. PhD student in … academic year….semester.

Debrecen, …..

……
head of the department/institute or academic advisor

UNIVERSITY OF DEBRECEN

Training plan

THE DOCOTRAL SCHOOL OF NUTRITION AND FOOD SCIENCES

Food Sciences Program

Accreditation in the field of agricultural sciences in no. 4.4 food sciences

Content

1.The structure of the food sciences program

During their training, students can take 3 different types of courses, compulsory, compulsorily optinal and optional. A list of the different categories of courses is given in the table of contents of the doctoral programme.

Study (training) credits can be obtained by studying and passing the examinations or the requirements of the given course. The number of study (training) credits to be completed during the first 4 semesters of the doctoral programme in food science program is 22 credits. The completion of the credits, based on the examination, essay, report, etc., required for the subject taken, is certified by the lecturer of the subject in the electronic study system (Neptun). Credit can only be assigned to a subject which is graded on a five-point scale with a merit mark. No credits can be obtained in doctoral studies through language learning and holding courses.

The majority of the 240 credits required for the doctoral programme are research credits. The completion of the credits shall be certified by the supervisor on the basis of a written report submitted by the doctoral student every semester. After the end of each semester, the subject supervisor submits the doctoral student's semester reports to the head of the doctoral school.

Admission into the program

Admission is carried out in accordance with the rules of procedure for doctoral studies. During the interview, the committee will also assess the applicant's interest, knowledge and presentation skills. The members of the admissions committee are members of the doctoral school's council. It examines the applicant's ideas for doctoral work, his/her professional knowledge, previous academic activities and language skills.

2.Fullfilling the requirement of the programs

During their doctoral studies, at the end of the fourth semester, at the end of the training and research phase and as a condition for starting the research and dissertation phase, students must pass a complex examination that measures and evaluates their academic and research progress.

3.Complex exam

To be admitted to the complex examination, the student must have completed at least 120 credits in the "training and research phase" (first four semesters) of the doctoral programme and all the "training credits" required by the doctoral school's curriculum (except for those preparing individually for the doctoral degree). The complex examination must be applied for in writing (see Annex 4 of the ADT Regulations). Since the student enters the degree-awarding procedure after passing the complex examination, the application for the complex examination is also the application for the degree procedure.

The complex examination must be taken in public before a committee appointed by the Doctoral Council of the discipline. The examination board shall be composed of at least three members, at least one third of whom shall not be employed by the institution operating the doctoral school. The chairperson of the examination board shall be a university professor or a

researcher with the title of Professor Emeritus or Doctor of the Hungarian Academy of Sciences. All members of the examination board hold a PhD degree. The candidate's supervisor is not allowed to be a member of the examination board.

Before the complex examination, the supervisor evaluates the performance of the doctoral student in writing and declares whether he or she recommends the start of the degree procedure.

The complex examination is divided into two main parts: one part assesses the candidate's theoretical knowledge ("theoretical part") and the other part reports on the candidate's academic progress ("dissertation part"). In the theoretical part of the complex examination, the candidate will be tested in at least two subjects/topics, the list of which is set out in the doctoral school's training plan. The theoretical part of the examination may include a written part. In the second part of the complex examination, the candidate will give a presentation on his/her knowledge of the literature, his/her research results, his/her research plan for the second stage of doctoral training, and the timetable for the preparation of the dissertation and the publication of the results. The supervisor should be able to assess the candidate during the examination.

The examining board will mark the theoretical and dissertation parts of the exam separately. A report of the complex examination, including a written assessment, is drawn up. The results of the examination are announced on the day of the oral examination. A complex examination is successful if a majority of the members of the board pass both parts of the examination. A doctoral student may repeat a failed complex examination once during the same examination period. If both parts of the complex examination are unsuccessful, the candidate may repeat the entire examination once in the same examination period. If a candidate fails the theoretical or dissertation part of the examination, he/she may repeat the failed part once in the same examination period.

For the fifth semester of the doctoral programme, a doctoral student can only enrol after passing the complex examination.

4.Pausing the program

If the student announces that he/she does not wish to fulfil his/her student obligations for the next training period or if the student does not enrol for the next training period, his/her student status will be terminated.

The continuous period of suspension shall not exceed two semesters. The cumulative duration of the interruption during the doctoral studies may not exceed six semesters. The Doctoral Council may, at the request of the student, authorise a suspension of the student's studies for a continuous period longer than that provided for in the preceding paragraph, provided that the student is unable to fulfil the obligations arising from the student's studies through no fault of his/her own, whether due to childbirth, accident, illness or other unforeseen circumstances. A student may only be suspended for a full semester. No state scholarship may be paid during the period of suspension.

Student status is terminated - at the end of the fourth semester of doctoral studies - if the doctoral student fails to pass the complex examination;

- by earning absolutorium

- at the end of the 14. semester counted from the admission into the program

- at the end of the eighth semester of the doctoral programme for which the student is registered

5.Requirements of earning absolutorium

The doctoral student will be awarded a diploma after successful completion of six semesters. The diploma certifies that the doctoral student has fulfilled all the obligations of the doctoral programme. To be awarded the diploma, the candidate must have obtained at least 240 credits. These may be obtained by completing professional courses as already described. The award of the diploma is also conditional on the candidate's progress in the research topic being certified by the supervisor each semester (by signature in the index and by a mark in Neptun). A doctoral student who has not obtained the required 240 credits will not be awarded the diploma. In justified cases, the Doctoral Council of the discipline may waive the requirement to obtain part of the credits.

6.Courses of food program

title of course	lecturer	credit	type
Nutrition and functional food	Dr. Zoltán Szilvássy	2	compulsory
Major research fields of food science	Dr. József Prokisch	3	compulsory
Quality and quantity analyses of food and food raw materials	Dr. Béla Kovács	2	compulsory
General Research methods	Dr. László Csernoch	1	compulsory
Making sense of data in food and life sciences	Dr. József Baranyi	2	compulsory
Complex examination (zero credit course)	Dr. Péter Pepó	0	compulsory
Food chemistry competence block			
Food chemistry I. - II. - III.	Dr. Erzsébet Kovács, Sándorné Kincses Dr.	3	comp. optional
Element speciation methods in food tests	Dr. Béla Kovács	2	optional
Elemental analyses (AAS, ICP), spectroscopic methods of food analysis	Dr. Béla Kovács	2	optional
Bioactive components and their analysis in vegetables & fruits	Dr. Judit Remenyik	2	optional
Rules and methods for the production of food allergens and allergen-free products	Dr. József Prokisch	2	optional
Nanoparticles in food	Dr. József Prokisch	2	optional
Analysis of food industry waste	Dr. Péter Tamás Nagy	2	optional
Food microbilogy competence block			

Recent results of food biotechnology I.	Dr. István Pócsi	1	comp. optional
Recent results of food biotechnology II.	Dr. Valter Pfliegler	1	comp. optional
Recent results of food biotechnology III.	Dr. Tamás Emri	1	comp. optional
Mycotoxins in the food chain – detecting their effect and the regulation of their biosynthesis I. - II.	Dr. Tünde Pusztahelyi, Dr. Tamás Emri	3	comp. optional
Microbiological rapid methods for analysis of food quality and safety	Dr. Erzsébet Karaffa	2	optional
Microbiomes: New perspectives in the research of microbiomes: the importance of commensal, opportunistic, and food microbes	Dr. Valter Pfliegler	2	optional
Actualities of microbiome research, possible areas of practical use	Dr. Melinda Paholcsek	2	optional
Food technology competence block			
Physical and rheological examination of food I. - II. - III.	Dr. Péter Sipos	3	comp. optional
Innovation in the food industry, development of functional food I. - II.- III.	Dr. József Prokisch	3	comp. optional
Special food technologies	Dr. Péter Sipos, Judit Gálné Dr. Remenyik	2	optional
Recycling technologies of agricultural and food industry organic material	Dr. János Tamás	2	optional
Development and fortification possibilities of cereal-based products	Dr. Gerda Diósi	2	optional
Post-harvest technology	Dr. Erzsébet Karaffa	2	optional
Food safety and sustainability competence block			
Fundamentals of risk assessment in food safety	Dr. Andrea Zentai	2	optional
Use of quality systems in the food production chain	Dr. Nikolett Czipa	2	optional
Food toxicology	Dr. József Prokisch	2	optional
Legal and public health aspects in the market placement of food	Dr. Andrea Lugasi	2	optional
Researching the effects of climate change (drought, flood) in terms of food safety with remote-sensing procedures	Dr. János Tamás	2	optional
Precision agriculture and food quality	Dr. János Tamás	2	optional
Interrelations of food safety and water supply management	Dr. Attila Nagy	2	optional
The relationship between food quality and plant physiology	Dr. Brigitta Tóth	2	optional
Nutrition science competence block			
Genetic and cell molecular basics of nutrition research based on animal modelling systems	Dr. Endre Máthé	2	optional

Fitonutrients in nutrition	Dr. Szilvia Veres	2	optional
Nutrition and food marketing	Dr. Zoltán Szakály	2	optional

Summary of the course credits to be obtained during the first four semesters of the food program:

course type	number of course to be completed	number of credits to be obtained
compulsory courses	6	10 credits
compulsorily optional courses	2	6 credits
optional courses	3	6 credits
Total	11	22 credits

7.Course schedule – food science program

student name:

research supervisor:

research title:

Form	Course	lecturer	semester								credit	signature of lecturer
			1.	2.	3.	4.	5.	6.	7.	8.		
Compulsory	General research methods	Dr. László Csernoch		x							1	-
	Quality and quantity analyses of food and food raw materials	Dr. Béla Kovács	x								2	-
	Making sense of data in food and life sciences	Dr. József Baranyi				x					2	-
	Nutrition and functional food	Dr. Zoltán Szilvássy		x							2	-
	Major research fields of food science	Dr. József Prokisch			x						3	-
	Complex examination	Dr. Péter Pepó				x					0	-
Compulsorily-optional	1.		x	x	x						3	
	2.			x	x	x					3	
Optional	1.		x								2	
	2.			x							2	
	3.				x						2	
course credit			6	7	7	3	-	-	-	-	**22**	
research credit			24	23	23	27	30	30	30	30	**218**	
Total			30	30	30	30	30	30	30	30	**240**	

date: ……..

signature of supervisor: ……

8. Content and thematics of courses

Major research fields of food science

Subject supervisor: Dr. Prokisch József

Aim of course, (semi) skills and competence to be acquired:

Alternative proteins and their sources. This includes both animal-derived alternative proteins such as insects and cultured meat, and non-animal alternatives such as plants and algae. Edible insects: the science of novel food evaluations. Novel carbohydrates as novel food – this comprises novel fibre, human identical milk oligosaccharides (e.g. sucrose, lactose), and novel foods intended to replace sugars. New food supplements legislation – this focuses on plant extracts, synthetic cannabidiol and engineered nanomaterials. Cell culture-derived foods of animal or plant origin and food ingredients produced through precision fermentation. Insects represent a promising source of proteins and have been reported as a great potential for being used as novel food and feed proteins. This makes them a valuable source of nutrients to face the increasing demand for food necessitated by the growing global population. The current European food legislation. Since the Novel Food Regulation. Genetically modified ingredients and their legislation. Food improvement agents are chemical substances which are used as food additives, food enzymes, flavourings and smoke flavourings added to food.

method of assesment/total number of course hours: based on arrangement with the teacher, 42 hours

Literature:

Nutraceutical and Functional Food Components: Effects of Innovative Processing Techniques, Editor: Charis Galanakis Academic Press, 2017.

Nutrition and functional food

Subject supervisor: Dr. Zoltán Szilvássy

Aim of course, (semi) skills and competence to be acquired:

Our aim is to introduce students to the latest findings of modern, evidence-based nutrition science, the current transfer of theoretical knowledge into practice, and the public health relevance of guidelines and recommendations. Nutrition science is concerned with the beneficial and adverse effects of diets and dietary components, their role in health promotion and disease management. Functional foods and fortified foods are used to promote health. Their biological effects and significance are discussed using examples of some products. The course will cover the following areas: Basic concepts of nutritional science. Nutrition science methodology. Principles of healthy nutrition. Methods of healthy dietary recommendations. Public health implications of dietary recommendations. Nutrient bioavailability metabolism. Nutrient components, nutrient toxicology. Nutrient requirements, defining guidelines. Nutrients determining infant-child development. Nutrients affecting brain development. Dietary factors involved in the prevention of cardiovascular diseases. Prevention and treatment of obesity . Relationship between a healthy diet and type 2 diabetes mellitus. The role of antioxidant nutrients in disease prevention. The role of nutrition in the prevention of osteoporosis. Xenohormesis mechanisms to enhance stress tolerance. The role of nutrition in the prevention of neurodegenerative diseases

(dementia, Alzheimer's disease). The role of nutrition in the prevention of eye diseases (cataracts, retinopathies). The role of dietary fibre in disease prevention. The role of gut flora in our nutrient supply and metabolism of nutrients. Macronutrient deficiency states of global importance. Micronutrient deficiency states of global importance. Comparison of dietary supplements, functional foods. Role of functional foods in health maintenance. Functional food product examples, their biological effects.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Nutrition in the Prevention and Treatment of Diseases , ed by A.M. Coulston, C.J. Boushey, M.G. Ferruzzi, Elsevier Science and Technology Books, Academic Press, 2013.
Nutrition, Epigenetics and Health (2016) Ed. Graham Burdge, Karen Lillycrop. CRC Press

Making sense of data in food and life sciences
(course held in English only)

Subject supervisor and presenter: Dr. József Baranyi

Aim of course, (semi) skills and competence to be acquired:

This one-week-long course is intended primarily for life scientists to demonstrate the proper use of mathematical modelling, computational and statistical techniques to analyse their data, to generate predictions and to make decisions based on the data and the predictions.
The course makes everyday concetps like standard error of estimation, confidence interval, or "statistically significant ($p<0.05$)" understandable. It is to boost the paerticipants' confidence in using such statistical terms in their publications.

Pre-requisites:
For hands-on exercises, participants will need a laptop with Microsoft Excel installed on it. No statistical package will be used; the built-in functions / procedures and the Data Analysis and Solver Add-ins of Excel will be sufficient.

Programme:
Day 1. Basics of Quantification of observations.
- Variables and parameters. Scaling and reparameterizaton.
- Quantification of dissimilarity. Cost function for disagreements.
- Linearization and approximation. Deterministic and random effects. Simulation in Excel.

Day 2. Basics of statistics
- Random variables. Expected value, standard deviation and variance. Random number generation for simulation.
- Approximations of distribution functions; histogram generation. Distributions of transformed random variables.

Day 3. Statistical tests
- Analysis of Variance. T-test, chi-2 test, F-test.
- Confidence intervals and significance levels.

Day 4. Fitting models to data
- The Least Squares Method. Linear regression. Fitting by polynomials.
- Estimates and their standard errors.

Day 5. Test (2 hours, analyzing data in Excel)

Literature:
Helmut F. van Emden: Statistics for Terrified Biologists.
BLACKWELL PUBLISHING, 2008.

Elemental analyses (AAS, ICP), spectroscopic methods of food analysis

Subject supervisor: Dr. Béla Kovács

Aim of course, (semi) skills and competence to be acquired:

The objective of the subject is for PhD students to have the opportunity to become familiar with modern elemental analysis methods, thus the subject introduces the most important elemental analytical, mainly instrumental analytical measurement methods needed to determine the quality and composition of food products and raw materials. The structure of the subject: Ultraviolet-visible absorption spectrophotometry (UV-VIS), Flame photometry (FES), Flame atomic absorption spectrometry (FAAS), Graphite furnace atomic absorption spectrometry (GF-AAS), Inductively coupled plasma optical emission spectrometry (ICP-OES), Inductively coupled plasma mass spectrometry (ICP-MS). During the semester, it deals with the theoretical principle of the above instrumental analytical measurement methods, detailing the information needed to analyse quality and quantity, the more important parts in the structure of the instruments, detailing the measurement errors arising from the application of measurement techniques, as well as their elimination, or at least their reduction, as well as the application possibilities of the analytical methods. Comparison and evaluation of the above analytical methods, as well as their applicability.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Mandatory literature:

Beaty R.D., Kerber J.D.: 1993. Concepts, instrumentation and techniques in atomic absorption spectrophotometry. The Perkin-Elmer Corporation, Norwalk, CT, USA.
Boss, C. B. Fredeen, K. J.: 1997. Concepts, instrumentation, and techniques in inductively coupled plasma optical emission spectrometry. The Perkin-Elmer Corporation. USA.
Chhabil Dass: 2007. Fundamentals of contemporary mass spectrometry. Wiley Interscience, New Jersey. ISBN: 978-0-471-68229-5
Kovács B., Csapó J.: (2015) Modern methods of food analysis. University of Debrecen, Debrecen.
Meyers R. A. (Ed.): 2011. Encyclopedia of analytical chemistry. John Wiley & Sons Ltd. ISBN: 9780470027318. DOI: 10.1002/9780470027318
Montaser, A. & Golightly, D. W.: 1992. Inductively coupled plasmas in analytical atomic spectrometry. VCH Publishers. New York. ISBN 3-527-28339-0
Montaser, A.: 1998. Inductively coupled plasmas mass spectrometry. VCH Publishers. New York. ISBN: 978-0-471-18620-5
Nelms S.M.: 2005. Inductively coupled plasma mass spectrometry handbook. Blackwell Publishing Ltd. ISBN: 978-1-405-10916-1

Recent results of food biotechnology - I.

Subject supervisor and instructor of the subject: Prof. Dr. István Pócsi, Head of Department, PhD, DSc (HAS)

The purpose of teaching the subject, (partial) skills and (partial) competences to be mastered:

Among the subfields of biotechnology, the course provides a comprehensive overview of the latest research results and current developmental trends of food biotechnology. The subject focuses on the food biotechnological applications of modern "omic" techniques and the diverse and dynamically expanding possibilities of the food biotechnology use of microscopic fungi. I recommend the course to all students who are interested in the results of modern, molecular-based biotechnology.

The topic of the subject:

The course covers the following biotechnological areas: "Omics" in modern biology and biotechnology, "omics" - a general overview, fungi in genomics and metagenomics research. The latest results of food biotechnology, the subject as well as present and future development trends of food biotechnology, functional foods, nutraceuticals, prebiotics, probiotics, synbiotics and psychobiotics, the basics of nutrigenomics, nutrigenetics and foodomics. The latest results of mycotoxin research, biologically and biotechnologically important, fungi-produced volatile organic compounds. Vaccines and human proteins expressed in plants, molecular farming. Ensuring the production of plant raw materials, biological control technologies. Each major chapter is complemented by a review of the latest literature as well as by a presentation and discussion of the most important publications published in recent years.

method of assesment/total number of course hours: based on arrangement with the teacher, 14 hours

Recommended literature:

Food Associated Pathogens, Editor: Danielsson-Tham, M.L., CRC Press, Boca Raton (2013)
Food Biotechnology, Editors: Shetty, K. et al., CRC Press, Boca Raton (2006)
Microbial production of food ingredients, enzymes and nutraceuticals, Editors: McNail, B. et al., Woodhead Publishing, Oxford (2013)
Milk and Dairy Products as Functional Foods, Editor: Kanekanian, A., John Wiley & Sohns, Chichester (2014)
Modern Food Microbiology, Springer Science+Business Media, New York (2005)
Probiotics and Prebiotics in Food, Nutrition and Health, Editor: Ötleş, S., CRC Press, Boca Raton (2014)

Recent results of food biotechnology - II.

Subject supervisor and instructor of the subject: Dr. Valter Péter Pfliegler, assistant professor

The purpose of teaching the subject, (partial) skills and (partial) competences to be mastered:

The course gives an overview of the food biotechnological applications of yeasts, the strain improvement possibilities and current trends concerning molecular and other types of strain improvement. The students can learn about the actual research trends, patents in these topics along with examples from Hungary.

The topic of the subject:

The overview of yeasts, their taxonomy, ecology, genomic characteristics. The species *Saccharomyces cerevisiae* and its close relatives. Traditional foods and beverages fermented using yeasts, and their modern counterparts. The microbial terroir, location-specific starter cultures. New trends in the production and development of traditional fermented foods. Research and patents in related fields.

Molecular strain improvement and evolutionary strain development among beer yeasts and other yeast types. The potential uses of non-conventional yeasts. Functional foods containing yeasts. Yeast probiotics and their design strategies. The larger topics of this course are completed by the review of current research papers related to the topics.

method of assesment/total number of course hours: based on arrangement with the teacher, 14 hours

Literature:

Non-conventional Yeasts: from Basic Research to Application, Szerkesztő: Sibirny, A., Springer Cham (2019)

Recommended literature:

Improving industrial yeast strains: exploiting natural and artificial diversity. Steensels J, Snoek T, Meersman E, Picca Nicolino M, Voordeckers K, Verstrepen KJ. FEMS Microbiol Rev. (2014) 38(5): 947-995.
Probiotics and Prebiotics in Food, Nutrition and Health, Szerkesztő: Ötleş, S., CRC Press, Boca Raton (2014)

Recent results of food biotechnology - III.

Subject supervisor and instructor of the subject: Prof. Dr. Tamás Emri, PhD, DSc

The purpose of teaching the subject, (partial) skills and (partial) competences to be mastered:

The aim of the course is to introduce the use of genomics and transcriptomics methods in mycotoxin research and the production of secondary metabolites important for pharmaceutical biotechnology. The course is recommended for all students interested in the results of modern, molecular-based biotechnology.

The topic of the subject:

Overview of secondary metabolites, their practical importance, biosynthesis and industrial production. Genomic and transcriptomic data, basics of data analysis. Advantages and limitations of genomic and transcriptomic methods. Achievements in the study of mycotoxins and secondary metabolites important for pharmaceutical biotechnology using genomic and transcriptomic methods.

method of assesment/total number of course hours: based on arrangement with the teacher, 14 hours

Literature:

Scientific publications, selected in the light of the latest research and the interests of the students.

Recommended literature:

Food Biotechnology, Editors: Shetty, K. et al., CRC Press, Boca Raton (2006)
Microbial production of food ingredients, enzymes and nutraceuticals, Editors: McNail, B. et al., Woodhead Publishing, Oxford (2013)
Modern Food Microbiology, Springer Science+Business Media, New York (2005)

Innovation in the food industry, development of functional food

Subject supervisor: Dr. József Prokisch

Aim of course, (semi) skills and competence to be acquired:

Learning the methodology of food product development, food fermentation in practice. Developing foods with health claims. Research, innovation and production: creation and exploitation of intellectual products. Entrepreneurship in food production and science. Patent, prototype, business development strategies. Constraints and opportunities. Domestic, European and American practice. The place of the researcher in the enterprise at different stages of company development. Steps and opportunities in firm development. Practical examples of successful and unsuccessful firms. Special position of biotechnology companies in the market.
In practice: building your own company, developing a business model and business plan based on an original idea. By the end of the course, the student will be able to judge whether he/she is suitable to start his/her own business, what role to take in a start-up or developing company. Personality tests, job application, employee selection in practice.
In lecture: distinguishing between innovation and research. Entrepreneurship. Spin-off, start-up companies. Venture capital and bank capital. The role of venture capital in financing start-ups. How to get start-up capital? Partner in entrepreneurship. Employee and boss roles. Manager or boss? Different personality types, MBTI model. Legal issues and opportunities related to intellectual property. Secrecy and confidentiality. The investment process. Relationship between firms. Clusters, opportunities for SMEs in clusters. Selling the company, possibilities of transformation, vision of development.
Competences. They will learn strategies for becoming an employee or owner to find a job that best suits their personality. They will be able to start a business based on their own ideas and research, and to find partners and capital.
Development of functional foods, active ingredients, development strategies, marketing. Regulatory constraints and opportunities.

method of assesment/total number of course hours: based on arrangement with the teacher, 42 hours

Literature:
Prokisch József: Strategy of the Pharmapolis Innovative Food Claster

Food Chemistry

Subject supervisor: Dr. Kincses Sándorné, Dr. Kovács Erzsébet

Aim of course, (semi) skills and competence to be acquired:

In frame of the Food Chemistry subject the students have to learn the chemical composition (water, dry material, ash contents) of foodstuff's row materials; furthermore, the binding of water, its movements in the foods, and the relationship between the water activity and the shelf life.
The chemical properties of the foodstuff's components (carbohydrates, proteins, lipids, vitamins, macro- and microelements, antioxidants) and their changes at the storage and processing will be also teach. The students have to learn about the food additives, which will be added to the foodstuffs at a certain phase of the processing technology. They will study the modern conserving stuffs and their mechanism of effectivity; the influence of "E-number components", such as aroma stuffs, colorants, emulgeators, gel forming agents on the quality of foodstuffs.
Students learn about the most important enzymes in terms of food science. They deal with general issues of biochemical changes in food (fermentation, respiration: grains, fruits, vegetables). They learn

about the changes in the properties of meat, eggs, milk and milk products during processing and storage (chemical composition, processes affecting the quality and ripening of meat).
After completing the course, the students together with knowledge from other subjects, will be able by using proper quality row materials, to choose the most optimal storage methods and kitchen technologies with the goal, the components of foods in suggested amounts and quality will be provided with the foodstuffs.

method of assesment/total number of course hours: based on arrangement with the teacher, 42 hours

Literature:

H.-D. Belitz, Werner Grosch, Peter Schieberle (20009): Food Chemistry. Springer Verlag, 4th edition, Berlin. ISBN 978-3-540-69933-0
JAN VALISEK (2014): The Chemistry of Food. Wiley Blackwell, John Wiley and Sons LTÉDI, Chichester. ISBN 978-1-118-38384-1
Handbook of Mineral Elements in Food. eds.: Miguel de la Guardia, Salvador Garrigues, Wiley Balckwell, 2005.

Physical and rheological examination of food

Subject supervisor: Dr. Sipos Péter

Aim of course, (semi) skills and competence to be acquired:

The aim of the course is to provide a detailed introduction to the physical and rheological methods of food analysis. In addition to raw material and finished product testing. The subject also cover the possibilities of offline and online measurement and the use and development of non-destructive methods, the application of physical methods to the measurement and estimation of chemical composition and the evaluation of the reliability of these methods. During the three semesters, the students will got a detailed description of the analysis of optical, spectral, electrical and rheological properties, their role and importance in manufacturing, product qualification and product development.

method of assesment/total number of course hours: based on arrangement with the teacher, 42 hours

Compulsory literature:

Ludger, Figura, Arthur A Texeira: Physical Properities- Measurement and Application. Springer Sciences and Business Media 2007.
Sipos Péter: Rheology in Food Analysis, Debreceni Egyetem 2014.
Malcolm C Bourne: Food Texture and Viscosity. (2nd edition) Concept and Measurement. Elsevier Inc 2002.
Practical Food Rheology: An Interpretive Approach Ian T. Norton (Editor), Fotios Spyropoulos (Editor), Philip Cox (Editor) ISBN: 978-1-4051-9978-0, 2011, Wiley-Blackwell

Mycotoxins in the food chain – detecting their effect and the regulation of their biosynthesis I.-II.

Subject supervisor: Dr. Tünde Pusztahelyi (part I. – 2 credits)

Subject supervisor: Dr. Tamás Emri (part II. – 1 credit)

Aim of course, (semi) skills and competence to be acquired:

To provide PhD students with a more detailed picture of the toxinogenic fungi and their products that are important in the food chain. The possibilities of degradation and elimination of the toxins produced, methods of toxin analysis, physiological effects of toxins. Masked mycotoxins. Overview of toxigenic fungi and toxin formation (taxonomy, recognition, metabolism). Topics covered: criteria for fungal development and prerequisites for toxin formation. Organisation of gene clusters responsible for the formation of secondary metabolites, characteristics and molecular background of cluster-specific and global regulatory mechanisms responsible for the induction of these clusters. Results of recent research areas (genomics, proteomics). Major model organisms of nematode fungi (Aspergillus, Penicillium, Fusarium). Possibilities for biological control of fungi. Overview of biological control options, role of yeasts and lactic acid bacteria. Analytical methods: overview of HPLC, ELISA, lateral flow, LC/MS methods. During the lectures, the students will be introduced to the literature from previously known and recent publications.

method of assesment/total number of course hours: based on arrangement with the teacher, 42 hours

Literature:

Masked Mycotoxins in Food: Formation, Occurrence and Toxicological Relevance, Editors: C. Dall'Asta, F. Berthiller 2006, Royal Society of Chemistry, London
Micotoxin and Food Safety in Developing Countries: http://library.umac.mo/ebooks/b28045592.pdf
Micotoxin in Food 1st Edition, Editors: N Magan M Olsen Woodhead Publishing (2004)
Pusztahelyi T, Holb IJ and Pócsi I (2015). Secondary metabolites in fungus-plant interactions. Front. Plant Sci. 6:573.
Barreiro Carlos, García-Estrada Carlos and Martín Juan F. (2012). Proteomics Methodology Applied to the Analysis of Filamentous Fungi - New Trends for an Impressive Diverse Group of Organisms, Tandem Mass Spectrometry - Applications and Principles, Dr Jeevan Prasain (Ed.), ISBN: 978-953-51-0141-3, InTech, Available from: http://www.intechopen.com/books/tandem-mass-spectrometry-applications-andprinciples/proteomics-methodology-applied-to-the-analysis-of-filamentous-fungi-new-trends-for-an-impressivediv
De Vries RP, Riley R, Wiebenga A, et al. (2017). Comparative genomics reveals high biological diversity and specific adaptations in the industrially and medically important fungal genus Aspergillus. Genome Biology.;18:28. doi:10.1186/s13059-017-1151-0.
Carla Viegas, Ana Pinheiro, Raquel Sabino, Susana Viegas, João Brandão, Cristina Veríssimo: Environmental Mycology in Public Health 1st Edition: Fungi and Mycotoxins Risk Assessment and Management. Academic Press, 2015.
Nancy P. Keller, Geoffrey Turner: Fungal Secondary Metabolism, Methods and Protocols, in: Methods in Molecular Biology: Volume 944, 2012.
Susanne Zeilinger, Juan-Francisco Martín, Carlos García-Estrada: Biosynthesis and Molecular Genetics of Fungal Secondary Metabolites, Volume 2, Springer, 2015.
Juan-Francisco Martín, Carlos García-Estrada, Susanne Zeilinger: Biosynthesis and Molecular Genetics of Fungal Secondary Metabolites, Springer, 2014.

Element speciation methods in food tests

Subject supervisor: Dr. Béla Kovács

Aim of course, (semi) skills and competence to be acquired:

The objective of the subject is for PhD students to become familiar with attached analytical measurement methods, which can be considered as further development of modern element analysis methods (separation techniques + spectrometric methods), thereby gaining knowledge about the more important element speciation methods and element speciation knowledge required for speciation analyses of foods and food raw materials. During the teaching of the subject, the most important educational materials are the followings: Grouping of related speciation techniques, Separation and detection possibilities of element speciation analytical methods, Comparison of advantages and disadvantages of element speciation analytical methods, Possibilities of separation and detection methods for analysis of organic components, Sampling and sample preparation methods in speciation analyses, Detailing the most important attached speciation analytical systems in international practice, Introduction of the species of Arsenic, Selenium, Mercury, Tin and Lead and their determination methods, applications of the species of other elements and their determination methods. Introduction of API ion sources.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Mandatory literature:

Apostoli P., R. Cornelis, J. Duffus, P. Hoet, D. Lison and D. Templeton: 2006. Elemental speciation in human health risk assessment: Environmental health criteria 234. World Health Organization. ISBN 92 4 157234 5

Cornelis R., J. Caruso, H. Crews, K. Heumann: 2003. Handbook of elemental speciation: Techniques and methodology. John Wiley & Sons Ltd. ISBN: 0-471-49214-0

Cornelis R., J. Caruso, H. Crews, K. Heumann: 2005. Handbook of elemental speciation II: Species in the environment, food, medicine & occupational health. John Wiley & Sons Ltd. ISBN: 0-470-85598-3

Ebdon L., L. Pitts, R. Cornelis, H. Crews, O.F.X. Donard, P. Quevauviller: 2001. Trace element speciation for environment, food and health. The Royal Society of Chemistry. ISBN 978-0-85404-459-7

Hübschmann H-J.: 2015. Handbook of GC-MS. Fundamentals and applications. Wiley-VCH Verlag GmbH & Co. Weinheim, Germany. ISBN: 978-3-527-67432-9

Michalke B.: 2003. Element speciation definitions, analytical methodology, and some examples. Ecotoxicology and Environmental Safety. **56**:122-139. DOI: 10.1016/s0147-6513(03)00056-3

Naushad M. and M.R. Khan: 2014. Ultra performance liquid chromatography mass spectrometry. Evaluation and applications in food analysis. Taylor and Francis Group. Boca Raton. https://doi.org/10.1201/b16670

Núñez O., H. Gallart-Ayala, C.P.B. Martins, P. Lucci: 2015. Fast liquid chromatography–mass spectrometry methods in food and environmental analysis. Imperial College Press. ISBN 978-1-78326-493-3

Templeton D. M., F. Ariese, R. Cornelis, L-G. Danielsson, H. Muntau, H.P. Van Leeuwen, and R. Łobiński: 2000. Guidelines for terms related to chemical speciation and fractionation of elements. Definitions, structural aspects, and methodological approaches. Pure Appl. Chem. **72**(8):1453-1470. https://doi.org/10.1351/pac200072081453

Quality and quantity analyses of food and food raw materials

Subject supervisor: Dr. Béla Kovács

Aim of course, (semi) skills and competence to be acquired:

The basic objective of the course is to familiarise PhD students with the most important analytical methods, mainly instrumental analytical methods, necessary for determining the quality and composition of various foodstuffs and food raw materials.
The main topics covered during the first semester are: basic concepts in analytical chemistry, the analytical process, accuracy and reporting of results, basic statistical concepts and validation of measurement methods. Basic physical measurements in analytical chemistry. SI system of units. Introduction to classical analytical methods of measurement.
The basic objective of the course is to familiarise PhD students with the main analytical and, in particular, modern instrumental analytical methods of measurement necessary for the determination of the composition of food and food ingredients. Accordingly, the most important knowledge is UV/VIS photometry. Inductively coupled plasma optical emission spectrometry (ICP-OES). Inductively coupled plasma mass spectrometry (ICP-MS). It deals with the principles of the above instrumental analytical methods of measurement, details of the information required for the measurement of quality and quantity, the main construction of the instruments, details of the measurement errors arising from the measurement techniques and their elimination or at least reduction, and the possible applications of the measurement methods, bearing in mind that the above methods of measurement are intended to be used for the specific elemental analysis of foodstuffs and food raw materials. Accordingly, in the detailed discussion, the methods of measurement will be described through the presentation of qualitative and quantitative example analyses of food and food raw material samples. The above mentioned measurement methods will be compared, evaluated and their applicability will be detailed.
The course will continue with the analysis of inorganic components, with lectures introducing PhD students to the main separation analytical methods used in the determination of organic components in food and food raw materials. Accordingly, the main topics to be covered are: the principles of chromatographic methods, their classification, their applications
Historical background of the development of chromatographic methods, their importance in the analysis of foodstuffs. Principles of chromatographic methods, classification of chromatographic methods and their applications. Quantitative and qualitative information. Parts of a gas chromatograph, different columns and packings, sample introduction systems, detectors. Types of gas chromatography. Applications of gas chromatography. Classification of HPLC methods, description of different chromatographic methods. Parts of a liquid chromatograph, different columns and packings, sample introduction systems, detectors. Applications of liquid chromatography. The importance and construction of the mass spectrometer. Advantages of the mass spectrometer compared to other detectors. Introduction to the different types of mass spectrometers and their operation. Application of the mass spectrometer in gas chromatography and high performance liquid chromatography. Since chromatographic methods of measurement are intended to be applied to the analysis of food and food raw materials, mainly their organic components, detailed discussions will be given through qualitative and quantitative example analyses of food and food raw material samples.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Pokol György, Gyurcsányi E. Róbert, Simon András, Bezúr László, Horvai György, Horváth Viola, Dudás Katalin Mária: (2011) Analitikai kémia. Typotex Kiadó, Budapest.
Kőmíves J.: (2000) Környezeti analitika. Műegyetemi Kiadó.
Tatár Enikő, Záray Gyula: (2012) Környezetminősítés. Typotex Kiadó, Budapest.

Heltai György, Kristóf János: (2011) Környezeti analitika. Pannon Egyetem, Veszprém.
Kovács Béla, Csapó János: (2015) Az élelmiszervizsgálatok műszeres analitikai módszerei. Debreceni Egyetem.
Béla Kovács, János Csapó: (2015) Modern methods of food analysis. University of Debrecen, Debrecen.
Mu Naushad and Mohammad Rizwan Khan: (2014) Ultra performance liquid chromatography mass spectrometry. Evaluation and applications in food analysis. Taylor and Francis Group. Boca Raton.
Oscar Núñez, Héctor Gallart-Ayala, Claudia P. B. Martins, Paolo Lucci: (2015) Fast liquid chromatography–massspectrometry methods in food and environmental analysis. Imperial College Press.
Hans-Joachim Hübschmann: (2015) Handbook of GC-MS. Fundamentals and applications. Wiley-VCH Verlag GmbH & Co. Weinheim, Germany.

Fundamentals of risk assessment in food safety

Subject supervisor: Dr. Andrea Zentai

Aim of course, (semi) skills and competence to be acquired:

Food safety, risk analysis, basics of risk assessment, legislative environment and international trends, main examples of practical implementation. The course covers the following areas: The place and role of risk assessment in food safety. The place and place of risk assessment in food safety, its role, place in food safety, place of risk assessment in food safety, place of risk assessment in food safety, place of risk assessment in food safety, place of risk assessment in food safety, legislation. Sources of potential food safety risks International guidance, risk assessment and management organisations. EFSA, Codex, RASFF. Four steps of risk assessment. Hazard and health effects. Acute and chronic risk. Input estimation. Deterministic and probabilistic approaches. Demonstration of the possibilities of probabilistic estimation using practical examples. Risk assessment of pesticide residues. New challenges in risk assessment: nanotechnology, novel foods.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

EFSA: Overview of the procedures currently used at EFSA for the assessment of dietary exposure to different chemical substances. *EFSA Journal* 2011; 9(12):2490
EFSA: Guidance on the use of probabilistic methodology for modelling dietary exposure to pesticide residues. *EFSA Journal* 2012;10(10):2839
FAO: Submission and evaluation of pesticide residues data for the estimation of maximum residue levels in food and feed. *FAO Plant Production and Protection Paper* 197. 2009. http://www.fao.org/docrep/012/i1216e/i1216e00.htm
WHO: Guidelines for predicting dietary intake of pesticide residues. 1997. WHO/FSF/FOS/97.7. http://www.who.int/foodsafety/publications/pesticides/en/

Use of quality systems in the food production chain

Subject supervisor: Dr. Nikolett Czipa

Aim of course, (semi) skills and competence to be acquired:

The aim of the course is to introduce the theory and practice of quality in the food chain in food raw material production, food processing, storage, transport and marketing enterprises of different sizes and functions. Legal regulation of food quality, Act LXXXII of 2003 on foodstuffs. Food safety and food supply safety concepts. Food safety, food supply and food safety standards. Quality management systems of food chain actors (ISO, EFSIS, BCR, EURO-GAP, HACCP). The actors involved in the implementation of quality management (producers, storers, processors, suppliers, traders) and their role in the management of the processes. The process of setting up and certifying quality management systems, their controls and ways of maintaining them.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

P.A Luning, F. Devlieghere, R.Verhé: Safety in the agri-food chain Wageningen Academic Publishers 2007

Bioactive components and their analysis in vegetables & fruits

Subject supervisor: Judit Gálné Dr. Remenyik

Aim of course, (semi) skills and competence to be acquired:

The aim of the course is to provide students with the basic knowledge of modern separation techniques, which will enable them to determine the nutritional parameters and bioactive components of fruit and vegetables using quantitative and qualitative analytical methods. In addition, they will acquire a protocol that allows the isolation of new types of chemical components. Topics. Properties of oligosaccharides, characterization of the main oligosaccharides. Occurrence of simple sugars in plants, their determination. Methods of measurement of proteins, their separation. Measurement of water and fat soluble vitamins. Measurement of energy balance. Organic micropollutants. Fatty acid profile and isoprene derivatives. Phenolic components, gallic acid derivatives. Key steps in the biosynthesis of the compounds. Characterisation of their physical and chemical properties, on the basis of which a suitable isolation technique can be chosen. Introduction to the most important analytical methods, their theoretical basis and application.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Natural Bioactive Compounds from Fruits and Vegetables as Health Promoters: Part 1
Luís Rodrigues da Silva, Branca Maria Silva, DOI: 10.2174/97816810823941160101,
Bentham eBooks, 2015
Bioactive Foods in Promoting Health, Fruits and Vegetables, *Edited by:Ronald Ross Watson and Victor R. Preedy*, ISBN: 978-0-12-374628-3 , 2010, Elsevier Inc.
Extracting bioactive compounds for Food Products, Theory and Application, M. Angela A. Meireles, CRC Press, 2008

Nanoparticles in food

Subject supervisor: Dr. József Prokisch

Aim of course, (semi) skills and competence to be acquired:

The purpose of teaching the subject, skills, and competencies to be acquired: Learning the methodology of food industry product development, and food processing in practice. Development of foods with health claims. Research, innovation, and production: the creation and utilization of the intellectual product. Entrepreneurship in food production and science. Patent, prototype, and business development strategies. Constraints and opportunities. Domestic, European, and American practice. The place of the researcher in the company at different stages of company development. Steps and possibilities of company development. Practical examples of successful and unsuccessful companies. The special position of biotechnology companies in the market. In practice: building your own company, developing your business model and business plan based on an original idea. By the end of the course, the student will be able to judge whether he is suitable for starting his own business, and what role he should take on in a start-up or developing company. Personality tests, job application, employee selection in practice. In lecture: Distinguishing between innovation and research. Business forms. A spin-off, start-up company. Risk and bank capital. The role of venture capital in the financing of start-up enterprises. How to get start-up capital? Partner in the business. Employee and boss role. Manager or boss? Different personality types, MBTI model. Legal issues and opportunities related to intellectual property. The secret and secrecy. The process of investing. Relationship between companies. Opportunities for clusters and SMEs in the cluster. The sale of the company, its transformation possibilities, and the future vision of development. Competences: After mastering the subject material, students are able to evaluate themselves as entrepreneurs, and are able to decide what role is suitable for them in a start-up business. They learn the strategy of becoming an employee or owner, finding the job that best suits their personality. They become capable of starting a business based on their own ideas and research and looking for a partner and capital for this. Development of functional foods, active ingredients, development strategies, and marketing. Limitations and opportunities arising from regulation.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Compulsory literature:

József Prokisch: The strategy of the Pharmapolis Innovative Food Industry Cluster

Food toxicology

Subject supervisor: Dr. József Prokisch

Aim of course, (semi) skills and competence to be acquired:

The purpose of teaching the subject, skills, and competencies to be acquired: Knowledge of potentially toxic substances in food, properties of poisons, their effects, occurrence, food safety, and toxic substances. Potentially toxic substances in food. Toxicology of arsenic (compounds, their toxicity, mechanism of poisoning, symptoms, treatment, stories, arsenic in the environment, in food) Toxicology of lead, mercury, and cadmium (their compounds, their toxicity, mechanism of poisoning, symptoms, treatment, case studies), other toxicological characterization of metals (Cr, Tl, Se, Sn, Cu, Ge, Al, Sb, Ag), the toxicity of organic compounds (VOC, PAH, PCB, pesticides), the toxicity of

gases, toxicology of radioactivity, most important animal and plant poisons, fungal toxins, chemical, and biological weapons, marking and handling of dangerous substances.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Compulsory literature:

Food Toxicology, D. Bagchi A. Swaroop (2016) CRC Press

Rules and methods for the production of food allergens and allergen-free products

Subject supervisor: Dr. József Prokisch

Aim of course, (semi) skills and competence to be acquired:

The aim of teaching the subject, skills, and competencies to be acquired: Learning about allergens in food. Rules for the production of allergen-free foods. Manufacturing conditions for allergen-free products. Market opportunities. Topics covered during the course: Food allergens. Gluten, milk sugar, milk protein, peanuts, crab, eggs, celery, and other allergens. Food allergy and food intolerance. Regulation of foods for special nutritional purposes, changes in regulation. Possibilities, problems, and opportunities for the production of gluten-free bakery products. The lactose-free dairy industry. Substitutes for allergens in food. Marking of products. Gastronomy and food allergens at home and abroad. Development of gluten-free products. Creation of allergen-free plants. In practice: production of gluten-free bakery and confectionery products: bread, pizza, scones.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Compulsory literature:

Marianne Polgár: Childhood food allergies Csapó J., Csapóné Kiss Zs.: Milk and milk products in nutrition Mezőgazda Kiadó 2002.
Food Allergens, Biochemistry and Molecular Nutrition, Tanja Ćirković Veličković , Marija Gavrović-Jankulović ISBN: 978-1-4939-0841-7

Innovation in the food industry, development of functional foods

Subject supervisor: Dr. József Prokisch

Aim of course, (semi) skills and competence to be acquired:

The purpose of teaching the subject, skills and competences to be mastered: Learning the methodology of food industry product development, food processing in practice. Development of foods with health claims. Topics covered during the course: Research, innovation and production: the creation and utilization of the intellectual product. Entrepreneurship in food production and science. Patent, prototype, business development strategies. Constraints and opportunities. Domestic, European and American practice. The place of the researcher in the company at different stages of company development. Steps and possibilities of company development. Practical examples of successful and unsuccessful companies. The special position of biotechnology companies in the market. In practice: building your own company, developing your business model and business plan based on an original idea. By the end of the course, the student will be able to judge whether he is suitable for starting his

own business, and what role he should take on in a start-up or developing company. Personality tests, job application, employee selection in practice. In lecture: Distinguishing between innovation and research. Business forms. A spin-off, start-up company. Risk and bank capital. The role of venture capital in the financing of start-up enterprises. How to get start-up capital? Partner in the business. Employee and boss role. Manager or boss? Different personality types, MBTI model. Legal issues and opportunities related to intellectual property. The secret and secrecy. The process of investing. Relationship between companies. Opportunities for clusters and SMEs in the cluster. The sale of the company, its transformation possibilities, and the future vision of development. Competences: After mastering the subject material, students are able to evaluate themselves as entrepreneurs, and are able to decide what role is suitable for them in a start-up business. They learn the strategy of becoming an employee or owner, finding the job that best suits their personality. They become capable of starting a business based on their own ideas and research and looking for a partner and capital for this. Development of functional foods, active ingredients, development strategies, and marketing. Limitations and opportunities arising from regulation.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Compulsory literature:

József Prokisch: The strategy of the Pharmapolis Innovative Food Industry Cluster
Innovation Strategies in the Food Industry 1st Edition, Charis Galanakis, Academic Press (2016)

Special food technologies

Subject supervisor: Dr. Péter Sipos, Dr. Judit Remenyik

Aim of course, (semi) skills and competence to be acquired:

Novel food processing processes based on basic food technologies. Their impact on the quality and shelf-life of the finished product, packaging and transport specialities. The course will cover the following topics: high hydrostatic pressure, pulsed electric field, food applications of vacuum cooking, various distillation processes, modified atmosphere packaging, gentle preservation processes, membrane operations, food water and wastewater treatment, these technologies are applicable to horticultural, arable and animal products. Production of special products (organic, eco, kosher, halal, paleo).

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Engineering Aspects of Food Biotechnology.. Jose A. Teixeira, Antonio A. Vicente;, CRC Press, 2013
Engineering and Food for the 21st Century. J. Welti-Chanes, J. M. Aguilera; CRC Press, 2002
Biotechnology in Functional Foods and Nutraceuticals. D. Bagchi, F. C. Lau, D, K. Ghosh;
CRC Press, 2010
Postharvest Technology and Food Process Engineering. A. Chakraverty, R. P. Singh; CRC Press, 2014
Gluten-free cereal products and beverages. eds.: Elke K. Arendt, Fabio Dal Bello, Elsevier Press, 2008
Handbook of Mineral Elements in Food. eds.: Miguel de la Guardia, Salvador Garrigues, Wiley Balckwell, 2005
Canning, Freezing,Curing &Smoking Meat, Fish & Game. Wilbur F. Eastman Jr., Storey Publishing, 2002 pp. 226. (ISBN 1-58017-457-4.)
The Complete Manual of Small-scale Food Processing. Peter Fellows, Parctical Action Publishing,

Rugby, UK, 2013 pp. 550.

Nutrition and food marketing

Subject supervisor: Dr. Zoltán Szakály

Aim of course, (semi)skills and competence to be acquired:

The aim of the course is for the students to become familiar with the basic relationships of nutrition and food marketing, as well as the tools and methods used. The course includes an examination of food purchasing and consumer behavior. During the course, we pay special attention to the segmentation of the market, the selection of the target markets and the positioning of the products. Product, price, distribution channel and marketing communication strategies and tools are discussed in detail. The concept of collective agricultural marketing, its tools and the analysis of applicable strategies are an important element of teaching the subject. In the nutrition marketing section, we specifically cover the marketing strategies of functional foods and the possible directions of innovation. By completing the course, students will master the correlation system of nutrition and food marketing, and will be able to apply it in a complex way both in theory and in practice. Structure of the subject: Characteristics and peculiarities of nutrition marketing. Characteristics and peculiarities of food marketing. The system and influencing factors of food buyer and consumer behavior. Analysis of food consumer behavior trends. Special features of SZCP marketing in the food industry. Segmentation, selection of target markets, positioning, the role of market niches. The role of the product in the marketing mix. Product quality, branding, packaging, the product life cycle. The role of price and contract terms in nutrition and food marketing. The role of the sales channel in food marketing. Concepts, basic contexts, actors and functions. The importance and application possibilities of the marketing communication mix. Strategic innovation development directions in nutrition and food marketing. Types of marketing strategies in the functional food market. The role and possibilities of social marketing in the food industry.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Lehota, J. (ed.): Food business marketing. Technical Publishing House, Budapest, 2001.
Szakály, Z.: Nutrition marketing. Mezőgazda Publishing House, Budapest, 2011.
Szakály, Z. (ed.): Food business marketing. Academic Publishing House, Budapest, 2018.

Fitonutrients in nutrition

Subject supervisor: Dr. Szilvia Veres

Aim of course, (semi)skills and competence to be acquired:

In addition to meeting the quantitative needs of the population, nutrition science is increasingly being called upon to meet them qualitatively. In addition to traditional artisanal, functional, etc. food products, international attention is turning to so-called health foods as part of the health industry. A significant proportion of medical foods are of plant origin, due to their phytonutrient content. Phytonutrients have no significant nutrient supplying capacity for the human body, but they have

properties that help to maintain homeostasis, as they are active substances, phytochemicals, which play a role in both the prevention of diseases and the treatment of illnesses.
both in the prevention and treatment of diseases. In addition to their beneficial effects for plants in stressful situations, their consumption has a positive impact on the health and well-being of the consumer. The quality and quantity of their occurrence is determined and influenced by a number of external and internal factors. The knowledge content of the course provides a basis for the development of novel foods due to its multidisciplinary approach. light quality, quantity; water deficit and surplus; cold and hot temperatures; cultivation technology and biotic effects). The importance of xenohormesis in the response of some plant species to stress.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Salter, A., Wiseman, H., Tucker, H. (ed): Phytonutrients, ISBN: 9781405131513, Blackwell Publishing Ltd., 2012
Sparrow, S.: Phytochemicals: What you should know – a quick booklet about phytonutrients, ISBN: 1501004379, CreateSpace Independent Publishing Platform, 2014
Tarr, F.: A flavonoidok, ISBN: 9636409765, Nyíregyházi Főiskola Fizika Tanszék kiadásaFascinating Facts about Phytonutrients in Spices and Healthy Food. Louis S. Premkumar. Xlibris LLC. Bloomington, IN, USA, (2014) ISBN: 978 – 1- 4931 5001-4

Genetic and cell molecular basics of nutrition research based on animal modelling systems

Tárgyfelelős: Dr. Endre Máthé

Aim of course, (semi)skills and competence to be acquired:

Students will acquire knowledge in the following areas: nutritional research based on animal models. Problems of inter- and multidisciplinary research in the light of a systems biology approach. Interdisciplinary and interdisciplinary approaches to systems biology and biology. Molecular phenomena related to macro- and micronutrient and energy status of cells and their regulation. The fractal system of gerontogenes: lifespan regulator, mediator, stress resistance-gene with general basic function, mitochondrial regulator, senescence and apoptosis genes. Innovative feed and food development based on nutritional genetics and genomics.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Aggarwal, B.B., Heber, D. (2014). Immunonutrition: Interactions of Diet, Genetics, and Inflammation. CRC Press, ISBN: 9781466503854.
Fonyó, A. (2012). Élettan gyógyszerészhallgatók részére. Medicina Könyvkiadó Zrt. ISBN 978 963 226 393 9
Graham, G., Kesten, D., Scherwitz, L. (2011). Pottenger's Prophecy: How Food Resets Genes for Wellness or Illness. ISBN: 978-1-935052.
Jorde, L.B., Carey, J.C., Bamshad, M.J. (2009). Medical Genetics. 4th edition. Mosby, ISBN-10: 0323053734.
Kohlmeier, M. (2012). Nutrigenetics Applying the Science of Personal Nutrition. Academic Press. ISBN: 978-0-12-385900-6

Lanham-New, S.A., Macdonald, I.A., Roche, H.M. (2010). Nutrition and Metabolism, 2nd Edition. Wiley-Blackwell. ISBN: 978-1-4051-6808-3
Shanahan, C. and Shanahan, L. (2008). Deep Nutrition: Why Your Genes Need Traditional Food. ISBN-10: 0-615-22838-0.
PUBMED database /Books:
Pagon RA, Adam MP, Ardinger HH, et al., editors. (1993-2014). GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993-2014.
Understanding Genetics: A District of Columbia Guide for Patients and Health Professionals. Genetic Alliance; District of Columbia Department of Health. Washington (DC): Genetic Alliance; 2010 Feb 17.
Integrating Large-Scale Genomic Information into Clinical Practice: Workshop Summary. Institute of Medicine (US). Washington (DC): National Academies Press (US); 2012.
Benzie I.F.F. and Wachtel-Galor, S. (2011). Herbal Medicine, 2nd edition. CRC Press; 2011. ISBN-13: 978-1-4398-0713-2

Legal and public health aspects in the market placement of food

Subject supervisor: Dr. Andrea Lugasi

Aim of course, (semi)skills and competence to be acquired:

Knowledge of the legal requirements for foods for general consumption and foods for particular nutritional uses, knowledge of the public health conditions and the legal environment governing the development and marketing of functional foods, ability to apply the legal requirements. In this course, students will learn about the legal conditions for the marketing and placing on the market of different types of foodstuffs, with particular reference to certain speciality products. Foodstuffs for particular nutritional uses, their public health aspects and market surveillance; food supplements, their composition, their public health assessment, the presentation of potential risks, expert assessment of the composition of herbal products. Marketing conditions for products called functional foods, regulation of novel foods, rules on fortified foods. Health claims on foods. The scientific basis for the regulation of trans-fatty acids. The scientific background to the public health product tax. Public health risks of energy drinks. Salt reduction programmes. Public health risks of added sugars and saturated fats.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Lugasi A.: Regulation of food supplements, scientific evaulation of components In: Farmacology – Phitochemistry. Use of Herbs. Eds..: Szőke Éva, Semmelweis Egyetem, Budapest, ISBN 978-963-9129-87-0, 2012. www.tankonyvtar.hu

Regulations:

Regulation (EC) No 178/2002 of the European Parliament and of the Council laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety
Regulation (ECSC) No 36/2004 of 26 April 2004 on foodstuffs intended for particular nutritional uses

Regulation (EC) No 20/2008 of 14 May 2008 on infant formulae and follow-on formulae
Regulation (EC) No 24/2004 of 9 May 2004 on infant formulae for special medical purposes
Regulation (EC) No 35/2004 (26 April 2004) on processed cereal-based foods and baby foods for infants and young children
Regulation (ECSC) No 27/2004 of 24 April 2004 on foods intended for use in energy-restricted diets for weight reduction
Regulation (ECSC) No 37/2004 of 26 April 2004 on food supplements
Regulation (EC) No 258/97 of the European Parliament and of the Council concerning novel foods and novel food ingredients
Regulation (EC) No 1925/2006 of the European Parliament and of the Council on the addition of vitamins and minerals and of certain other substances to foods
Regulation (EC) No 1924/2006 of the European Parliament and of the Council on nutrition and health claims made on foods
Regulation (EU) No 609/2013 of the European Parliament and of the Council on foods intended for infants and young children for special medical purposes and on foods intended as weight-replacement foods for infants and young children as well as on foods intended as complete daily diets and repealing Council Directive 92/52/EEC, Commission Directives 96/8/EC, 1999/21/EC, 2006/125/EC and 2006/141/EC, Directive 2009/39/EC of the European Parliament and of the Council and Commission Regulations (EC) No 41/2009 and (EC) No 953/2009

Researching the effects of climate change (drought, flood) in terms of food safety with remote-sensing procedures

Subject supervisor: Dr. János Tamás

Aim of course, (semi)skills and competence to be acquired:

Upon completion of the course, the student will be able to assess the quantitative and qualitative links between climate impacts and food raw materials. Identify the intervention points and how they can be addressed. Topics. Types of weather extremes, their frequency and impact on the quantity and quality of food raw materials. Forms and measurement of drought. Physical background of remote sensing technology. Applied remote sensing sensors and platforms. Soil and crop drought damage mitigation and prevention options. Assessment of drought spatial and temporal distribution using remote sensing time series techniques - Drought risk assessment. Drought forecasting and monitoring. Spatial and temporal distribution of tidal waters. Flood protection. Flood risk assessment and mitigation. Impact of runoff on product quality. Spectral vegetation indices and food commodity quality assessment and regional evaluation methodology.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Tamás, J., Lénárt, Cs., Burai, P. (2009):Evaluation of applicability of airborne AISA DUAL hyperspectral imaging system to map environment conditions in orchards. CIGR V. pp. 14.
Nagy, A., Tamás, J.(2008): Hiperspektrális technológiák alkalmazhatósága in situ fitoremediáció megalapozására. *Agrártudományi Közlemények,* Debreceni Egyetem. 30.71-78.
Tamás, J., Nagy, A.(2009): Green Vegetation Evaluation Based on Narrow Band Vegetation Indexes. Transport of water, chemicals end energy in the soil-plant-atmosphere system IH, SAS, Bratislava, ISBN 978-80-89139-19-5-665-671.
Tamás, J., Szabó, Z.(2010): Hyperspectral evaluatiom of the prear trees on the basis of the genetic collection of different species. In: Wagner, W., Székely, B., (eds.) IAPRS, Vol. XXXVIII. Part 7B.

ISSN 1682-1777. pp. 563-567.

Recycling technologies for agricultural and food organic materials

Subject supervisor: Dr. János Tamás

Aim of course, (semi)skills and competence to be acquired:

Upon completion of the course, the student will be able to evaluate waste management processes in the agricultural and food industry. Subject areas. Main characteristics of waste types. Waste pyramid and waste management principles. Main aspects of waste recovery technologies. Waste management and recycling techniques. Solid and liquid waste management. Energy recovery methods. Biogas production. Pyrolysis. Combustion. Disposal of end products. Recycling of by-products in different food sectors. International trends in organic recycling.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Tamás J.. Blaskó L. (2008) Environmental management.
http://www.tankonyvtar.hu/hu/tartalom/tamop425/0032_kornyezettechnologia/ch09s15.html
Tamás J. 2008. Vízkezelés és Szennyvíztisztítás. Tankönyv. Debreceni Egyetem- Veszprémi Egyetem. HEFOP 3.3.1. 180.
FAO 2013. Food waste footprint. Impacts on natural resources. ISBN 978-92-5-107752-8
FAO. 2011. Global food losses and food waste – Extent, causes and prevention. Rome
Foster, C., Green, K., Bleda, M., Dewick, P., Evans, B., Flynn A., Mylan, J. (2006). Environmental Impacts of Food Production and Consumption: A report to the Department for Environment, Food and Rural Affairs. Manchester Business School. Defra, London.
Halász A., Baráth Á., Hegóczky J., Sárkány P.,Nagyné Gasztonyi M., Hajdú Gy-né (1997): A szesz-, sör-, bor-, gyümölcslé- és üdítőital ipar környezeti hatásainak vizsgálata. Magyarország az ezredfordulón. MTA stratégiai kutatások, Budapest

Precision agriculture and food quality

Subject supervisor: Dr. János Tamás

Aim of course, (semi) skills and competence to be acquired:

After completing the course, the student will be able to evaluate the quantitative and qualitative relationships between the effects of production location and the quality and quantity of food raw materials. Identify the intervention points and how they should be addressed. Subjects covered. Principles of operation and applicability of field sensors. Establishment of precision farming and monitoring systems. Information technology background for precision agriculture: data collection, decision support. Impact of precision farming technology on the quantity and quality of food commodities: cereal crops, protein crops, oil crops, fodder crops. Impact of precision horticultural technologies on horticultural commodities. Impact of precision animal husbandry on food raw materials of animal origin.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Tamás J. (2002) Precíziós Mezőgazdaság. Szaktudás Kiadó. ISBN 963563399
Tamás, J., Neményi, M.(2008): Precíziós Mezőgazdaság. Debreceni Egyetem-Pannon Egyetem,tankönyv, Észak-alföldi Régióért KHT: Debrecen-Keszthely 180.
Tamás J., Németh T. (2005): Agrár-környezetvédelmi Indikátorok Elmélete és Gyakorlati Alkalmazásai Debreceni Egyetem, FVM Agrárkörnyezetvédelmi Kutatások 1-147.

Microbiological rapid methods for analysis of food quality and safety

Subject supervisor: Dr. Erzsébet Mónika Karaffa

Aim of course, (semi)skills and competence to be acquired:

The aim of the course is to provide up-to-date knowledge of the principles and applications of various rapid detection and identification tests, automated testing procedures, rapid instrumental methods, immunological and molecular biological methods used in the microbiological testing of foodstuffs. Areas covered: Rapid microbiological tests. Automated microbiological testing procedures. Rapid instrumental methods based on the detection of metabolites of microorganisms. Immunological methods. Methods based on direct analysis of DNA extracted from cells. Hybridisation techniques. Polymerase chain reaction (PCR) methods.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Patel D.P. (1995): Rapid analysis techniques in food microbiology
Mauer, J (2006): PCR Methods in foods
Brock Biology of Microorganisms. Global Edition. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl. Peerson Publishing, 2015, pp. 1030. (ISBN 978-1-292-01831-7)

Analysis of pesticides and pesticide residues

Subject supervisor: Dr. Lajos Kadenczki

Aim of course, (semi)skills and competence to be acquired:

Students working in food technology or food safety should have information about substances used in the crop production chain (cultivation, storage, transport) that can cause food safety problems. Pesticides are one of these substances. Therefore, it is essential to introduce methods to determine the presence of pesticides in our food. The subject will cover the following areas. The development and evolution of residue analysis and the chemical chemistry of pesticides. The application of chromatographic methods in pesticide analysis (thin layer chromatography, column chromatography, liquid chromatography, gas chromatography). Special analytical methods in residue analysis (individual methods, methods for the determination of pesticides belonging to a group of active substances, multi-residue methods). Instruments and instrument systems (detectors, complex systems).

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Ambrus Árpád (szerk.) Methods of food safety evaluation. I. II. Edison House Holding Zrt Budapest

Analysis of food industry waste

Subject supervisor: Dr. Péter Tamás Nagy

Aim of course, (semi) skills and competence to be acquired:

The objective of the course is to familiarise PhD students with the most important analytical and mainly instrumental analytical methods and measurement systems necessary for determining the quality and composition of waste products from food production.
Within the framework of the course, the comparison, evaluation and applicability of the individual measurement methods will be presented, with special emphasis on speciation testing and its significance in relation to food samples.
The subject will also cover the conditions under which certain food wastes are generated, their treatment and their use and disposal in the cereals, meat and dairy industries and in the field of preserved foods.
Students will evaluate the main types of waste generated during food production (kitchen technology waste, hazardous waste, special waste (e.g. GMO waste, etc.)).
They will analyse environmentally friendly techniques (zero- and low-emission) that can be applied in food technology.
In the framework of the course, students will acquire best available laboratory practice related to the field in the development of sampling strategies, sample preparation, measurement, interpretation and evaluation of data and results.
Furthermore, recent trends in scientific experimental measurement techniques in the field will be introduced.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Panda, H.: The Complete Book on Managing Food Processing Industry Waste. 2011. ISBN: 9788178331454
Maria Kosseva - Colin Webb (eds.): Food Industry Wastes. 1st Edition. 2013. Academic Press. Book ISBN: 9780123919281. Hardcover ISBN: 9780123919212.

Interrelations of food safety and water supply management

Subject supervisor: Dr. Attila Nagy

Aim of course, (semi) skills and competence to be acquired:

The objective of the course is to provide students with a framework for the relationship between food safety and climate adaptation. By completing the subject, students will be able to analyse the plant-soil-water relations at the watershed level, to evaluate and analyse the hydrological processes and water-habitat relations of the crop production area in the Carpathian Basin.

Students will be able to interpret the food security and watershed-level interactions. Students will learn the principles and methods of river basin management planning, with particular reference to the requirements of integrated water management and the water management policies and regulations of the European Union. The course provides up-to-date knowledge of food water footprint calculation and methodology.
Students will be able to interpret the drought process and to understand and apply the tools of practical agricultural drought management. Students will learn methods of assessing the interrelationships between meteorological, agricultural and hydrological drought patterns, their quantitative and qualitative parameters, their spatial and temporal extent, the measurement and calculation methods of evapotranspiration, which affect food security.
Students will learn the methodological processes of climate change adaptive water retention, water storage, water governance and sustainable management of our water resources. They will learn methods and tools for water and energy efficient irrigation technologies to meet the different land use and crop production needs for water resources management for food security.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Global Water Partnership Central and Easter Europe (2015). Guidelines for the preparation of Drought Management Plans. Development and implementation in the context of the EU Water Framework Directive, Global Water Partnership Central and Eastern Europe, 48. ISBN: 978-80-972060-1-7
World Meteorological Organization (WMO) and Global Water Partnership (GWP) (2014) National Drought Management Policy Guidelines: A Template for Action (D.A. Wilhite). Integrated Drought Management Programme (IDMP) Tools and Guidelines Series 1. WMO, Geneva, Switzerland and GWP, Stockholm, Sweden. ISBN: 978-92-63-11164-7 and 978-91-87823-03-9
World Meteorological Organization (WMO) and Global Water Partnership (GWP), 2016: Handbook of Drought Indicators and Indices (M. Svoboda and B.A. Fuchs). Integrated Drought Management Programme (IDMP), Integrated Drought Management Tools and Guidelines Series 2. Geneva. ISBN 978-92-63-11173-9 ISBN 978-91-87823-24-4
Global Water Partnership and the International Network of Basin Organizations (2009). A Handbook for Integrated Water Resources Management in Basins. Elanders, Sweden ISBN: 978-91-85321-72-8

Microbiomes: New perspectives in the research of microbiomes: the importance of commensal, opportunistic, and food microbes

Subject supervisor: Dr. Valter Péter Pfliegler

Hours: two lectures per week evaluated by a written exam

Aim of course, (semi) skills and competence to be acquired:

The microbiome and its definition. Phylogenetic taxonomy of the microbes that are important in the microbiome. Viruses, bacteria, archaea, fungi, and other Eukaryotes as members of th emicrobiomes of multicellular Eukaryotes. The microbiome in the case of fungi, plants, and animals. The holobiont approach to microbiomes. The human microbiome: important and rare species, differences according to age, gender, ethnicity, and environmental factors. The Human Microbiome Project. The microbiomes of indigenous peoples and ancient humans, paleomicrobiology. Microbiome and health,

relationships of the microbiome with the immune system and inflammation. The microbiome and the endocrine system. Brain-gut axis. Microbiome and metabolism. Vitamins produced by microbes. Cross-talk in microbial communities. The 'thanatobiome'. Fecal transplants. Phage therapy. Pobiotics and probiotic foods, new strain development strategies. The importance of food microbes in human health and the microbiome. Transient microbes, commensals, symbionts and opportunistic pathogens and shifts between these lifestyles. The macro- and microevolution of the members of the microbiome. The methodology of microbiome research: culture-based methods, targeted amplicon sequencing, metagenomics.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Recommended literature:

Allaband C, McDonald D, Vázquez-Baeza Y, Minich JJ, Tripathi A, Brenner DA, Loomba R, Smarr L, Sandborn WJ, Schnabl B, Dorrestein P, Zarrinpar A, Knight R (2018) Microbiome 101: Studying, Analyzing, and Interpreting Gut Microbiome Data for Clinicians. *Clinical Gastroenterology and Hepatology*. pii: S1542-3565(18)31008-5.
Drancourt M, Raoult D (eds.) (2016) Paleomicrobiology of Humans. ASM Press, Washington DC, USA. 212pp.
Haller D (2018) The Gut Microbiome in Health and Disease. Springer International Publishing 356pp.
Money NP (2018) The Rise Of Yeast: How Civilization Was Shaped By Sugar Fungi. Oxford University Press, New York, NY, USA. 224pp.

Schedule:

Week 1. The microbiome and its definition. Phylogenetic taxonomy of the microbes that are important in the microbiome. New results in microbial systematics.
Week 2. Viruses, bacteria, archaea, fungi, and other Eukaryotes as members of th emicrobiomes of multicellular Eukaryotes. The microbiome in the case of fungi, plants, and animals.
Week 3. The holobiont approach to microbiomes. The human microbiome: important and rare species, differences according to age, gender, ethnicity, and environmental factors. The uman Microbiome Project.
4Week 4. Microbiome and health: relationships of the microbiome with the immune system and inflammation.
Week 5. Microbiome and health: The microbiome and the endocrine system.
Week 6. Brain-gut axis. Microbiome and metabolism. Vitamins produced by microbes.
Week 7. The microbiomes of indigenous peoples and ancient humans, paleomicrobiology. The "thanatobiome".
Week 8. Cross-talk betwen host and microbe, and in microbial communities. Fecal transplants. Phage therapy.
Week 9. Pobiotics and probiotic foods, new strain development strategies.
Week 10. The importance of food microbes in human health and the microbiome. The complicated relationship between food microbes and humans.
Week 11. Transient microbes, commensals, symbionts and opportunistic pathogens and shifts between these lifestyles.
Week 12. The macro- and microevolution of the members of the microbiome.
Week 13. The methodology of microbiome research: culture-based methods, targeted amplicon sequencing, metagenomics.
Week 14. New research areas. Microbiome in our everday lives: news and fake news.
Week 15. Consultation.

The relationship between food quality and plant physiology

Subject supervisor: Dr. Brigitta Tóth

Aim of course, (semi)skills and competence to be acquired:

Meeting the food needs of a growing population is a major challenge of our time. In addition to quantitative needs, the quality of the plant foods produced is becoming increasingly important. The importance of the topic is also demonstrated by the fact that the achievement and provision of food production in inadequate quantity and quality also leads to social and political problems. Just think of the dramatic rise in food prices in 2008. Meeting these needs is a particular problem in developing countries, where the effects of global climate change are being felt even more acutely. Increased CO2 emissions and rising temperatures due to climate change are affecting the amino acid, protein and nutrient content of plants and the composition of lipids. Extreme precipitation patterns are also considered a cause of global climate change. Water supply also plays a crucial role in crop production. Adapting to changing environmental factors and increasing the quantity of production is unthinkable without biotechnological interventions, e.g. increasing resilience, breeding drought and salt tolerant crops, increasing water and nutrient use.
The maximum yield that can be achieved is genetically determined, but the actual quantity produced is determined by many factors. The most important thing is to provide the plants with all the necessary conditions for their growth and development, in optimal quantities. Of these conditions, the one over which the farmer has the most control is the supply of nutrients to the crop. Inadequate nutrient supply (e.g. nitrogen fertilisation) reduces the protein content of the wheat and changes the quality of the wheat, which also affects the quality of the flour. Therefore, in order to increase the quantity and quality of crop production, it is necessary to know the needs and metabolic processes of the plants.
The production of high quality plant food raw materials requires complex knowledge, including plant breeding, biotechnology and plant biology. The aim of the course is to summarise and familiarise students with the processes that take place in plants, the factors that influence them and how these affect the quantity and quality of the plant raw materials produced.

Topics:

- Plant metabolic processes
- Plant carbohydrate metabolism
- Nutrient uptake and nutrient requirements of plants
- Abiotic and biotic factors affecting food quality
- Impact of climate change on food quality through plant metabolic processes
- Factors affecting wheat quality and plant life processes
- Relationships between yield and hormone balance
- Factors affecting oil content of oilseed crops and plant life processes

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Fageria NK, Baligar VC, Clark RB (eds) 2006. Physiology of crop production. CRC Press, ISBN 9781560222897
Pessarakli M (ed) 1999. Handbook of plant and crop stress. Marcel Dekker Inc., New York, ISBN 0-8247-1948-4
Pethő Menyhért 2002. Mezőgazdasági növények élettana. ISBN 963 05 7945 6

Smirnoff N (ed) 1995. Environment and plant metabolism. BIOS Scientific Publishers Limited, ISBN 1 872748 93 7

Development and fortification possibilities of cereal-based products

Course supervisor: Dr. Geda Diósi

Aim of course, (semi) skills and competence to be acquired:

Product development is primarily about increasing the "value" or "worth" of the product. Usually, the chemical composition of the product is modified, enriched, and the structure or the technological processing and processability is changed. In the process of development, it is important to change the characteristics of a product or group of products as little as possible to meet customer needs. The product development objectives for the present subject are based on the achievement of technological processability (quality and qualification) and nutritional physiological effects.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Tze Loon Neoh, Shuji Adachi, Takeshi Furuta (2016): Introduction to Food manifacturing Engineering, ISBN 978-981-10-0441-4, ISBN 978-981-10-0442-1 (eBook)
R. paul Singh, Dennis R. Heldman (2014): Introduction to Food Engineering (Fifth Edition) ISBN 978-0-12-398530-9
Zeki Berk (2019): Food Process Engineering and Technology (Third Edition) ISBN 978-0-12-812018-7
Romeo T. Toledo, Rakesh k. Singh, Fanbin Kong (2018): Fundamentals of Food Process Engineering ISBN 978-3-319-90097-1, ISBN 978-3-319-90098-8 (eBook)

Postharvest technology

Subject supervisor: Dr. Erzsébet Mónika Karaffa

Aim of course, (semi) skills and competence to be acquired:

The aim of the course is to introduce the most important postharvest technologies for fruit.
The students will learn about the most important postharvest diseases and the characteristics of the pathogens involved on the most important fruits grown in temperate, tropical and subtropical areas. They will learn about the traditional physical, chemical and biological control methods of postharvest diseases and the latest research and practical results of the latest technologies. They will learn about different storage methods. Students will be able to develop appropriate postharvest technology based on the knowledge acquired.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Bautista-Baňos S., Ed., 2014. Postharvest decay – Control Strategies. Academic Press
Bautista-Baňos S., Romanazzi G., Jimenez-Aparicio A., Eds., 2016. Chitosan in the preservation of agricultural commodities, Academic Press
Palou L., Smilanick J., 2020. Postharvest pathology of fresh horticultural produce. CRC Press

Microbiological rapid methods for analysis of food quality and safety

Subject supervisor: Dr. Erzsébet Mónika Karaffa

Aim of course, (semi) skills and competence to be acquired:

The aim of the course is to provide up-to-date knowledge of the principles and applications of various rapid detection and identification tests, automated testing procedures, rapid instrumental methods, immunological and molecular biological methods used in the microbiological testing of foodstuffs. Areas covered: Rapid microbiological tests. Automated microbiological testing procedures. Rapid instrumental methods based on the detection of metabolites of microorganisms. Immunological methods. Methods based on direct analysis of DNA extracted from cells. Hybridisation techniques. Polymerase chain reaction (PCR) methods.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

Literature:

Patel D.P. (1995): Rapid analysis techniques in food microbiology
Mauer, J (2006): PCR Methods in foods
Brock Biology of Microorganisms. Global Edition. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl. Peerson Publishing, 2015, pp. 1030. (ISBN 978-1-292-01831-7)

Actualities of microbiome research, possible areas of practical use

Subject supervisor: Dr. Melinda Paholcsek

Aim of course, (semi) skills and competence to be acquired:

The subject discusses the basic knowledge required for research in the field of microbiome research by students of life sciences (biologists, general practitioners, veterinarians and agriculturists). It emphasizes the importance of next-generation sequencing techniques in the investigation of complex biological systems due to the practical application of targeted region and shotgun sequencing strategies. taxonomic profiling, equilibrium and dysbiotic core microbiomes such as measuring of alpha and beta diversities. How to apply functional metagenomics methods for determining metabolic profiles of communities. It also emphasizes the importance of analyzing social networks, role of network clusters in resilience, identification of tipping points. How to apply scale-independent and random networks in biological systems to promote microbiome-based biomonitoring strategies and resistance analyses? Investigation of the occurrence of antibiotic resistance, investigation of spread dynamics and mechanisms. Within the framework of the course, the importance of microbiome research will be also discussed in relation to soil life, biological activity, soil regeneration strategies, agroeconomy such as farm animals raised with intensive husbandry technologies.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

References:

1) Core Microbiome: Improving Crop Quality and Produc tivity; Parray JA (2022).
2) Angela E Douglas, Fundamentals of Microbiome Science How Microbes Shape Animal Biology

3) Loscalzo, Barabasi, Silverman. Network Medicine

Food and environmental safety, biotechnology

Subject supervisor: Dr. Tünde Pusztahelyi

Aim of course, (semi) skills and competence to be acquired:

Purpose of the course: To provide doctoral fellowship students with a more detailed picture of the significant biotechnology opportunities in food, existing technologies, waste recovery, and biocontrol opportunities.
The thematic of the subject: Biotechnology as a science. Fermented foods (traditional and new processes), starter cultures, probiotics, metabolism of starters. Meat products. Create new properties. Genetically modified organisms (GMOs). Advantages and disadvantages of GM. Detection of GM. Regulation. Principle of substantial equivalence. Fermented functional foods and their biogenic metabolites. Processing of food waste, residues. SCP. Biocontrol in food production. Environmental pressures caused by food and food production. Food safety.
During the lectures, students receive literature from materials from previously known and recent publications.

method of assesment/total number of course hours: based on arrangement with the teacher, 28 hours

References:

The issued course material.
Publications of international refereed journals.

9. Complex examination topics– food science program

Major subjects

1. Food chemistry
2. Food analytics
3. Nutrition science, latest research results
4. Food microbiology
5. Recent results of food biotechnology
6. Molecular biology and genetics
7. Food physics
8. Storage and processing of cereals and industrial plants
9. Preservation procedures
10. Fermentation processes
11. Processing of raw materials of animal origin
12. Food quality control
13. Food safety
14. Quality Assurance
15. Environmental protection of the food production chain
16. Making sense of data in food and life sciences
17. Innovation in the food industry
18. Nutrition and functional foods
19. Healthy eating

20. Nutrition-related diseases
21. Food marketing

Minor subjects

1. Elemental analysis (AAS, ICP) spectroscopic methods of food analysis
2. Quality control of food and food ingredients
3. Food production chain quality and safety requirements in the European Union
4. Innovation in the food industry, development of functional foods
5. Food chemistry
6. Physical examination of food
7. Mycotoxins in the food chain, effect-detection and regulation of their biosynthesis
8. Food safety assessment of agrochemicals
9. Element speciation methods in food tests
10. Basics of food safety risk analysis
11. Application of quality systems in the food chain
12. Bioactive components and their analysis of vegetable and fruit
13. Nanoparticles in food
14. Food toxicology
15. Rules and methods for the production of food allergens and allergen-free products
16. Special food technologies
17. Nutrition and food marketing
18. Phytonutrients in nutrition
19. Influence of plant nutrient supply on elements of human nutrition
20. Genetic and molecular cell biology essentials of nutrition research based on animal model systems
21. Legal and public health aspects of placing food on the market
22. Agricultural and food organic material recycling technologies
23. Investigation of the impact of climate change on food safety (drought, inland water) by remote sensing procedures
24. Precision agriculture and food quality
25. Rapid microbiological methods in food quality and food safety studies
26. Microbiomes: New perspectives in the research of microbiomes: the importance of commensal, opportunistic, and food microbes
27. Development and enrichment opportunities of cereal-based products
28. Post-harvest technology
29. Actualities of microbiome research, possible areas of practical use

10. Research topics of the doctoral program

research topics for the doctoral programme in food science: Analysis of the composition of different food raw materials and foodstuffs, development of analytical methods in the physical, chemical, microbiological and radiological fields of food production and safety, quality assurance systems in the food chain and their sub-analysis, analysis of the processes involved in the storage and processing of different food raw materials and food ingredients, water as an important element of the food chain, research into the conditions for the production of quality products and food ingredients, development and application of new food ingredients and additives in the food industry, development and application of bioactive nanoparticles in the food industry

The current, announced and previously announced research topics of the Doctoral Program in Food Science can be found in the National Doctoral Database. Available at: https://doktori.hu/index.php?menuid=191&lang=HU&di_ID=221

Appendix 1. : Research report template and information on completing the research report

UNIVERSITY of DEBRECEN

DOCTORAL SCHOOL OF NUTRITION AND FOOD SCIENCES
H-4002 Debrecen, 1st Egyetem sq., PO.: 400
Tel.: 52/512-900/88406

Research report

name:

semester:

year:

doctoral program: food sciences

……text of report…..

Debrecen, 20….. ……

……. …….

student's signature supervisor's signature

The research report was accepted by the doctoral school.

Debrecen,. …… 20…..

…….

Dr. Béla Kovács
head of doctoral program
food sciences doctoral program

Content requirements for the research report - Doctoral programme in Food Science:

The research report must include a detailed description of the research activities carried out during the semester. It should report on what tasks have been carried out and what results have been achieved. It should indicate where the student is in the research plan drawn up in the first semester of the programme and what has been achieved during the semester in terms of the objectives set out in the plan. It is also necessary to describe the publication activities, participation in conferences or professional events and progress in achieving the language requirements during the semester. Please also describe any other activities, such as teaching assignments, institute activities, project or proposal work, etc. The report should follow the format of the research report template in *Appendix 1*.