University of Debrecen
Faculty of Science and Technology
Institute of Biology and Ecology

BIOLOGY BSC PROGRAM

2023

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DEAN`S WELCOME

Welcome to the Faculty of Science and Technology!

This is an exciting time for you, and I encourage you to take advantage of all that the Faculty of Science and Technology UD offers you during your bachelor's or master's studies. I hope that your time here will be both academically productive and personally rewarding

Being a regional centre for research, development and innovation, our Faculty has always regarded training highly qualified professionals as a priority. Since the establishment of the Faculty in 1949, we have traditionally been teaching and working in all aspects of Science and have been preparing students for the challenges of teaching. Our internationally renowned research teams guarantee that all students gain a high quality of expertise and knowledge. Students can also take part in research and development work, guided by professors with vast international experience.

While proud of our traditions, we seek continuous improvement, keeping in tune with the challenges of the modern age. To meet our region's demand for professionals, we offer engineering courses with a strong scientific basis, thus expanding our training spectrum in the field of technology. Recently, we successfully re-introduced dual training programmes in our constantly evolving engineering courses.

We are committed to providing our students with valuable knowledge and professional work experience, so that they can enter the job market with competitive degrees. To ensure this, we maintain a close relationship with the most important companies in our extended region. The basis for our network of industrial relationships are in our off-site departments at various different companies, through which market participants - future employers - are also involved in the development and training of our students.

Prof. dr. Ferenc Kun
Dean

UNIVERSITY OF DEBRECEN

Date of foundation: 1912 Hungarian Royal University of Sciences, 2000 University of Debrecen

Legal predecessors: Debrecen University of Agricultural Sciences; Debrecen Medical University; Wargha István College of Education, Hajdúböszörmény; Kossuth Lajos University of Arts and Sciences

Legal status of the University of Debrecen: state university

Founder of the University of Debrecen: Hungarian State Parliament

Supervisory body of the University of Debrecen: Ministry of Education

Number of Faculties at the University of Debrecen: 13

Faculty of Agricultural and Food Sciences and Environmental Management

Faculty of Child and Special Needs Education

Faculty of Dentistry

Faculty of Economics and Business

Faculty of Engineering

Faculty of Health

Faculty of Humanities

Faculty of Informatics

Faculty of Law

Faculty of Medicine

Faculty of Music

Faculty of Pharmacy

Faculty of Science and Technology

Number of students at the University of Debrecen: 29,777

Full time teachers of the University of Debrecen: 1,587

203 full university professors and 1,249 lecturers with a PhD.

FACULTY OF SCIENCE AND TECHNOLOGY

The Faculty of Science and Technology is currently one of the largest faculties of the University of Debrecen with about 2,500 students and more than 200 staff members. The Faculty has got 6 institutes: Institute of Biology and Ecology, Institute of Biotechnology, Institute of Chemistry, Institute of Earth Sciences, Institute of Physics and Institute of Mathematics. The Faculty has a very wide scope of education dominated by science and technology (12 Bachelor programs and 14 Master programs), additionally it has a significant variety of teachers' training programs. Our teaching activities are based on a strong academic and industrial background, where highly qualified teachers with a scientific degree involve students in research and development projects as part of their curriculum. We are proud of our scientific excellence and of the application-oriented teaching programs with a strong industrial support. The number of international students of our faculty is continuously growing (currently ~790 students). The attractiveness of our education is indicated by the popularity of the Faculty in terms of incoming Erasmus students, as well.

THE ORGANIZATIONAL STRUCTURE OF THE FACULTY

Dean: Prof. Dr. Ferenc Kun, Full Professor
E-mail: ttkdekan@science.unideb.hu

Vice Dean for Educational Affairs: Prof. Dr. Gábor Kozma, Full Professor
E-mail: kozma.gabor@science.unideb.hu

Vice Dean for Scientific Affairs: Prof. Dr. Sándor Kéki, Full Professor
E-mail: keki.sandor@science.unideb.hu

Consultant on External Relationships: Prof. Dr. Attila Bérczes, Full Professor
E-mail: berczesa@science.unideb.hu

Consultant on Talent Management Programme: Prof. dr. Tibor Magura, Full Professor
E-mail: magura.tibor@science.unideb.hu

Dean's Office
Head of Dean's Office: Mrs. Katalin Kozma-Tóth
E-mail: toth.katalin@science.unideb.hu

English Program Officer: Mrs. Alexandra Csatáry
Address: 4032 Egyetem tér 1., Chemistry Building, A/101, E-mail: acsatary@science.unideb.hu

DEPARTMENTS OF INSTITUTE OF BIOLOGY AND ECOLOGY

Department of Botany
4032 Debrecen, Egyetem tér 1, Life Science Building

Head of department	Position	E-mail	room
Mr. Prof. Dr. Gábor Vasas, PhD, habil, DSc	University Professor, Head of Department	vasas.gabor@science.unideb.hu	LFS 1.506

Department of Ecology
4032 Debrecen, Egyetem tér 1, Ecology Building

Head of department	Position	E-mail	room
Mr. Prof. Dr. Tibor Magura, PhD, habil, DSc	University Professor, Head of Department	magura.tibor@science.unideb.hu	Ecol. Building 104

Department of Evolutionary Zoology and Human Biology
4032 Debrecen, Egyetem tér 1, Life Science Building

Head of department	Position	E-mail	room
Mr. Prof. Dr. Zoltán Barta, PhD, habil, DSc	University Professor, Head of Department. Head of Institute	barta.zoltan@science.unideb.hu	LFS 1.206

Department of Hydrobiology
4032 Debrecen, Egyetem tér 1, Ecology Building

Head of department	Position	E-mail	room
Mr. Dr. István Grigorszky, PhD, habil,	Associate Professor, Head of Department	grigorszky.istvan@science.unideb.hu	Ecol. Building 023

ACADEMIC CALENDAR

General structure of the academic semester (2 semesters/year):

Study period	1st week	Registration*	1 week
	2nd – 15th week	Teaching period	14 weeks
Exam period	directly after the study period	Exams	7 weeks

*Usually, registration is scheduled for the first week of September in the fall semester, and for the first week of February in the spring semester.

For further information please check the following link:

https://www.edu.unideb.hu/tartalom/downloads/University_Calendars_2023_24/University_calendar_2023-2024-Faculty_of_Science_and_Technology.pdf?_ga=2.243703237.1512753347.1689488152-28702506.1689488059

THE BIOLOGY BACHELOR PROGRAM

Information about the Program

Name of BSc Program:	Biology BSc Program
Specialization available:	
Field, branch:	Science
Qualification:	Biology
Mode of attendance:	Full-time
Faculty, Institute:	Faculty of Science and Technology Institute of Biology and Ecology
Program coordinator:	dr. Viktor Oláh, Associate Professor
Student adviser:	dr. István Gyulai, Assistant Professor
Duration:	6 semesters
ECTS Credits:	180

Objectives of the BSc program:

Our aim is to provide students with basic knowledge in the most important biological fields, to attain skills in fundamental methods of laboratory and applied biology and acquaint them with the most important processes of biochemistry, cytology, components of living organisms. The Biology BSc program covers a broad range of biological science including the most important concepts in modern biology; the levels of biological organization; the fundamental principles of structure and function and the development of ecosystems. The Institute of Biology and Ecology at the University of Debrecen has about 40 staff members, a third of whom are professors and associate professors with fluent English, established educational and research experience and regular research publications. The institute is well equipped and has an almost complete new Life Sciences library with more than 20000 books and about 200 journals in biology and ecology. Our libraries also enjoy the technical support and database of the National University Library of Debrecen. The institute is located in the two newest buildings of the Faculty of Science: the Life Sciences Building and the Ecological Building, with well equipped, spacious and computerized lecture rooms and laboratories.

Professional competences to be acquired

A Biologist:

a) Knowledge:

- He/she has a high level of knowledge about the living systems both above and below organism level. Able to apply, organise and develop this knowledge further.
- He/she knows the methods applied in modern field, laboratory and industrial biology.
- He/she knows and is able to apply the terminology and knowledge of the different areas of biology (cell biology, ecology, environmental and nature protection, microbiology, immunology, physiology, animal behaviour, genetics, evolutionary biology, biotechnology, structural biology, syntetic biology, botany and zoology.
- He/she knows the connections between the different biological disciplines and understands the importance of multidisciplinary approaches.
- He/she knows the theoretical and historical aspects of evolution of life on Earth and is able to argue scientifically for this view.
- He/she knows the possibility of applications of modern biological methods, recognises the importance of the development of new methodology and contributes to this development.
- He/she has usable knowledge of natural sciences.
- He/she senses and understands problems of the society which are rooted in biology.

b) Abilities:

- He/she is able to recognise the connections between different areas of science.
- He/she is able to recognise patterns in social processes related to nature and living organisms.
- He/she is able to carry out scientific research projects and produce (with appropriate supervision) new scientific results.
- He/she is able to use research methods and tools, plan and carry out investigations, interpret and present results of such investigations, learn and develop new methods.
- He/she is able to be an interdisciplinary thinker, build collaborations and coordinate division of labour between members of staff.
- He/she is able to think and act to achieve high level of quality control.
- He/she is able to manage, analyse and interpret scientific data.
- He/she has and develops skills for precise measurements.
- He/she is able to present and defend his/her views and perform well on job interviews.
- He/she is able to present his/her results and views in biology at a high level both in oral and written form.
- He/she joins the national and international scientific community and is able to communicate his/her results at a high level.
- He/she is able to work in a sustainable way.

c) Attitude:

- He/she aims to know and understand the interactions amongst humans and nature, the structure, function and evolution of humans and other organisms.
- He/she aims at expressing a responsible point of view about humans and nature, explain their relations for the widest possible audience, and positively influence the public view on biology according to the latest scientific findings.
- He/she sets an example by his/her behaviour concerning environment and nature. He/she acts to push environmental and nature conservation further.
- He/she follows and makes others to follow the ethics of scientific research.
- He/she spread the results of science in an active way even in the media, he/she is able to defend his/her views against pseudoscientific attacks.

- He/she works both in the field and laboratory in a sustainable way and sets examples in this way for others.
- He/she is open to learn new theories and experimental results and is eager to collaborate with others. He/she aims to develop his/her knowledge and set new research directions.
- He/she is committed to do high quality work, to improve his/her own and his/her fellows' knowledge and career.
- He/she is open to develop research consultancy services and spin-offs.
- He/she is open to continuously learn and collaborate with other groups. He/she actively seeks the possibility for personal and professional development and actively helps the flow of information.

d) Autonomy and responsibility:
- He/she has the ability to lead small research groups.
- He/she expresses his/her point of view responsibly in professional and non-professional circles about biological research, ethical and bioethical questions.
- He/she puts a great emphasis on work safety under all conditions.
- He/she has the self-determination to organise the work of small groups, and takes responsibility for this.
- He/she knows the legal conditions for safe work. He/she stands on his/her own and his/her fellows' interests at different forums and suggests changes to improve work conditions.
- He/she obtains work experience and helps others to work efficiently.
- He/she determinately builds his/her own career and helps others in doing so.

Completion of the BSc Program

The Credit System

Majors in the Hungarian Education System have generally been instituted and ruled by the Act of Parliament under the Higher Education Act. The higher education system meets the qualifications of the Bologna Process that defines the qualifications in terms of learning outcomes: statements of what students know and can do on completing their degrees. In describing the cycles, the framework uses the European Credit Transfer and Accumulation System (ECTS).
ECTS was developed as an instrument of improving academic recognition throughout the European Universities by means of effective and general mechanisms. ECTS serves as a model of academic recognition, as it provides greater transparency of study programs and student achievement. ECTS in no way regulates the content, structure and/or equivalence of study programs.
Regarding each major, the Higher Education Act prescribes which professional fields define a certain training program. It contains the proportion of the subject groups: natural sciences, economics and humanities, subject-related subjects and differentiated field-specific subjects.

During the program students have to complete a total amount of 180 credit points. It means approximately 30 credits per semester. The curriculum contains the list of subjects (with credit points) and the recommended order of completing subjects which takes into account the prerequisite(s) of each subject. You can find the recommended list of subjects/semesters in chapter “Guideline”.

Curriculum for Biology BSc students

Abbreviations: E, oral or written examination; P, practical, S, seminar

Modules	Subject/Lecturer	Code	Hours/week in semesters						Type of examination	Credit point
			1	2	3	4	5	6		
Module I.	**Basic Information I.** Dr. Viktor Oláh, Dr. István Gyulai	TTBBG1000_EN	0+1+0						S	1
	Safety Dr. György Deák	TTKBE0711_EN	2+0+0						E	3
	Basic environmental science Dr. Sándor Alex Nagy	TTEBE0040_EN	1+0+0						E	1
	Basic Matemathics and Informatics Dr. András Bazsó	TTMBE0801_EN	2+0+0						E	3
	Basic Matemathics and Informatics Dr. András Bazsó	TTMBG0801_EN	0+2+0						P	2
	Biostatistics Dr. Béla Tóthmérész	TTBBE1001_EN				2+0+0			E	3
	Biostatistics seminar Dr. Béla Tóthmérész	TTBBG1001_EN				0+2+0			S	3
	Chemical Basis of Biology Dr.János Kerékgyártó, Dr. Sándor Kun	TTBBE1005_EN		2+0+0					E	2
	Chemical Basis of Biology Dr. János Kerékgyártó	TTBBG2035_EN			0+0+2				P	3
	Introduction to chemistry Dr. Katalin Várnagy	TTKBE0141_EN	2+0+0						E	3
	Introduction to chemistry Dr. Melinda Földi-Bíró	TTKBL0141_EN		0+0+2					P	2
	Sampling, sample treatment, analytical tests Dr. Edina Baranyai	TTKBE0514_EN		1+0+0					E	1
	Sampling, sample treatment, analytical tests Dr. Edina Baranyai, Dr. István Gyulai	TTKBL0514_EN		0+0+4					P	4
	Basic Geology Dr. Péter Rózsa	TTGBG5103_EN	0+2+0						S	2
	Fundamentals of biology Dr. Ibolya Revákné Markóczi	TTBBE1010_EN	2+0+0						E	3
			9+5+0	**2+0+6**	**0+0+2**	**2+2+0**				**36**
Module II.	**Plant anatomy** Dr. Márta Hamvas, Dr. Csaba Máté	TTBBE2001_EN	2+0+0						E	3
	Plant anatomy lab. Dr. Márta Hamvas, Dr. Csaba Máté	TTBBL2001_EN	0+0+2						P	2
	Plant taxonomy Dr. Gábor Matus	TTBBE2005_EN	2+0+0						E	3
	Plant taxonomy Dr. Gábor Matus	TTBBL2005_EN		0+2+0					P	2
	Zoology I. Dr. András Tartally	TTBBE2010_EN		2+0+0					E	2
	Zoology II. Dr. Jácint Tökölyi	TTBBE2015_EN			2+0+0				E	2
	Animal taxonomy I. Dr. András Tartally	TTBBL2020_EN			0+0+2				P	3
	Animal taxonomy II. Dr. András Tartally	TTBBL2025_EN				0+0+2			P	3
	Animal anatomy Dr. Edit Juhász	TTBBL2030_EN		0+0+2					P	3
	Biochemistry Dr. János Kerékgyártó	TTBBE2036_EN		2+0+0					E	2
	Biochemistry seminar Dr. János Kerékgyártó	TTBBG2036_EN		0+1+0					S	1
	Cell biology Dr. Gábor Szemán-Nagy	TTBBE2045_EN		2+0+0					E	3

	Cell biology seminar Dr. Gábor Szemán-Nagy	TTBBG2045_EN			0+2+0				P	2
	Bioinformatics Dr. Mátyás Sipiczki	TTBBE2060_EN			1+0+0				E	2
	Bioinformatics Dr. Hajnalka Csoma	TTBBG2060_EN				0+2+0			P	2
	Hydrobiology Dr. Sándor Alex Nagy, Dr. István Grigorszky	TTBBE2065_EN			2+0+0				E	3
	Hydrobiology seminar Dr. István Gyulai	TTBBG2065_EN			0+1+0				S	2
	Hydrobiology lab Dr. István Bácsi, Dr. István Gyulai	TTBBL2065_EN			0+0+1				P	2
	Field practicals Dr. Gábor Matus	TTBBG2055_EN				*			P	2
			4+0+2	**6+3+2**	**5+4+3**	**0+2+2**				**45**

Modules	**Subject/Lecturer**	**Code**	**Hours/week in semesters**						**Type of exami-nation**	**Credit point**
			1	**2**	**3**	**4**	**5**	**6**		
Module III.	**Animal physiology I.** Dr. Zsuzsa Szigeti Máthéné	TTBBE3001_EN				2+0+0			E	3
	Animal physiology I. seminar Dr. Zsuzsa Szigeti Máthéné	TTBBG3001_EN					0+2+0		S	3
	Plant physiology I. Dr. Csaba Máthé	TTBBE3010_EN				2+0+0			E	3
	Plant physiology I. lab Dr. Viktor Oláh	TTBBL3010_EN				0+0+2			P	2
	Plant physiology II. Dr. Csaba Máthé	TTBBG3015_EN					0+2+0		S	3
	Genetics Dr. Gyula Batta	TTBBE3020_EN		2+0+0					E	3
	Molecular biology Dr. Ida Miklós Gálné	TTBBE3025_EN				2+0+0			E	3
	General microbiology and mycology Dr. Walter Péter Pfiegler	TTBBE3030_EN		2+0+0					E	3
	Biotechnology Dr. Éva Leiter	TTBBE3035_EN			2+0+0				E	3
	Basic Ecology Dr. Béla Tóthmérész	TTBBE3045_EN		2+0+0					E	3
	Basic Ecology seminar Dr. Béla Tóthmérész, Dr. Tibor Magura, Dr. Edina Kundrát-Simon, Dr. Péter Török, Dr. Dávid Nagy, Dr. Edina Tóth-Szabó, Dr. Roland Horváth	TTBBG3045_EN		0+2+0					S	3
	Biodiversity Dr. Béla Tóthmérész	TTBBE3050_EN			2+0+0				E	3
	Biodiversity seminar Dr. Edina Kundrát-Simon	TTBBG3050_EN			0+2+0				S	3
	Ecological examination methods Dr. Péter Török	TTBBE3055_EN						1+0+0	E	2
	Ecological examination methods practice Dr. Edina Kundrát-Simon	TTBBG3055_EN						0+2+0	S	3
	Evolutionary biology and population Genetics Dr. Nikoletta Nagy	TTBBE3060_EN					2+0+0		E	3
	Evolutionary biology and population Genetics practice Dr. Nikoletta Nagy	TTBBG3060_EN					0+2+0		P	2
	Biogeography Dr. Attila V. Molnár	TTBBE3065_EN						2+0+0	E	3

	Environmental and Nature protection Dr. Magdolna Kiss Kaszáné	TTBBE3070_EN					2+0+0		E	3
	Environmental and Nature protection practice Dr. Magdolna Kiss Kaszáné, Dr. István Gyulai	TTBBG3070_EN					0+2+0		P	2
	Animal Behaviour Dr. Zoltán Barta	TTBBE3075_EN			3+0+0				E	4
				6+2+0	**7+2+0**	**6+0+2**	**4+9+0**	**3+2+0**		**61**

Moduls	**Subject/Lecturer**	**Code**	**Hours/week in semesters**						**Type of exami-nation**	**Credit point**
			1	**2**	**3**	**4**	**5**	**6**		
Optional subjects 21 Credits	**Soil Science** Dr. Viktor Oláh	TTBBE4001_EN					1+1+0		E	3
	Plant ecophysiology Dr. Viktor Oláh, Dr. Ilona Mészáros	TTBBG4005_EN						0+2+0	S	3
	Paleolimnology and Aquatic Biomonitoring Dr.Istvan Gyulai	TTBBE4010_EN		1+1+0					E	3
	Toxicology and ecotoxicology Dr. Edina Kundrát-Simon	TTBBG4015_EN					2+0+0		E	3
	Medical plant products Dr. Gábor Vasas	TTBBG4020_EN						2+0+0	E	3
	Histology of medical plants seminar Dr. Márta Hamvas	TTBBG4025_EN					0+1+0		E	2
	Animal Ecology Dr. Edina Kundrát-Simon, Dr. Roland Horváth	TTBBE4030_EN						2+0+0	E	3
	Caseworks in Hydrobiology Dr. László Antal	TTBBG4035_EN				0+1+0			S	2
	Biochemistry II. Dr. Teréz Barna	TTBBE2040_EN				2+0+0			E	2
	Fundamentals of physics Dr. Balázs Ujvári	TTFBE2101					2+1+0		E,P	4
	Techniques of image formation Dr. Gábor Szemán-Nagy	TTBBE4040_EN						2+0+0	E	3
	Sustainability and current environmental issues Dr. Viktor Oláh	TTBBE4045_EN				2+0+0			E	3
	Plant Biochemistry and Molecular Biology Dr. Ilona Mészáros	TTBBE4050_EN						2+0+0	E	3
										37
Modul VI.	**Thesis I.**	TTBBG0001_EN				*				**2**
	Thesis II.	TTBBG0010_EN					*			**3**
	Thesis III.	TTBBG0020_EN						*		**5**
	Free optional subjects									**9**
Number of ECTS credits:										**180**

Work and Fire Safety Course

According to the Rules and Regulations of University of Debrecen each student has to complete the online course for work and fire safety. Registration for the course and completion are mandatory for graduation. For MSc students, the course is only necessary if their BSc diploma has been awarded outside of the University of Debrecen.
Registration in the Neptun system by the subject: MUNKAVEDELEM
Students have to read an online material until the end to get the signature on Neptun for the completion of the course. The link of the online course is available on webpage of the Faculty.

Physical Education

According to the Rules and Regulations of University of Debrecen each student has to fulfil at least two semesters of Physical Education during his/her Bachelor's training. Our University offers a wide range of facilities to carry them out. Further information is available from the Sport Centre of the University, its website is: http://sportsci.unideb.hu.

Pre-degree Certification

A pre-degree certificate is issued by the Faculty after completion of the bachelor's (BSc) program. The pre-degree certificate can be issued if the student (1) has successfully completed the study and exam requirements as set out in the curriculum, (2) the requirements relating to Physical Education as set out in Section 10 in Rules and Regulations– with the exception of preparing thesis – and (3) gained the necessary credit points (180). The pre-degree certificate verifies (without any mention of assessment or grades) that the student has fulfilled all the necessary study and exam requirements defined in the curriculum and the requirements for Physical Education. Students who obtain the pre-degree certificate can submit their theses and take the final exam.

Thesis

The thesis is based on an independent project work summarizing research by the student conducted under the supervision of a university professor. It serves to prove that students are able to collect and interpret literature information related to a specific problem and solve biological problems through data collection, analysis and interpretation. The topic of the thesis has to be selected in the 4th semester at the latest, however, students may join any research activity at the departments earlier. Thesis courses have to be completed in semesters 4, 5 and 6 with the total credit points of 10. The minimum length of the thesis is 15-20 typewritten pages, composed with A/4 paper size, 2.5 cm margins, 12 points Times New Roman letter size and type, and 1.5 spacing, respectively. The following chapters need to be included: Title page, Table of Contents; Introduction and review of literature; Objectives; Materials and Methods;

Results; Discussion; Summary; Acknowledgements; Bibliography. The literature review should cover a very minimum of 10 scientific articles (a scientific article is a piece of literature that is indexed in the scientific databases Web of Science, PubMed or Scopus). There are no further formal requirements, but the supervisor may make additional recommendations specific to the particular field of study.

Final Exam

(a) requirements for admission to the final examination;
Registration for the Final Exam requires that the student has already obtained the required 180 credits and submitted his/her thesis.
(b) final examination;
At the final exam the obtained knowledge is evaluated in an oral exam using topics covering the core material. Defending the thesis is part of the final exam in the form of a short presentation of the results summarized in the thesis work. Calculation of exam results is based on the Rules and Regulations. The final exam has to be taken in front of the Final Exam Board. If a candidate does not pass his/her final exam by the termination of his/her student status, he/she can take the final exam after the termination of the student status on any of the final exam days of subsequent academic years according to existing requirements on the rules of the final exam.

Final Exam Board
The Board chair and members are selected from the acknowledged internal and external experts of the professional field. Traditionally, it is the chair and in case of his/her absence or indisposition the vice-chair who will be called upon, as well. The board consists of – besides the chair – at least two members (one of them is an external expert), and questioners as required. The mandate of a Final Examination Board lasts for one year.

Repeating a failed Final Exam
If any part of the final exam is failed it can be repeated according to the rules and regulations. A final exam can be retaken in the forthcoming final exam period (typically the next semester). A repeated final exam can be taken twice on each subject.

Diploma

The diploma is an official document decorated with the coat of arms of Hungary which testifies the successful completion of studies in the Biology Bachelor Program. It contains the following data: name of HEI (higher education institution); institutional identification number; serial number of diploma; name of diploma holder; date and place of his/her birth; level of qualification; training program; specialization; mode of attendance; place, day, month and year issued. Furthermore, it has to contain the rector's (or vice-rector's) original signature and the seal of HEI. The University keeps a record of the diplomas issued.

In Biology Bachelor Program the diploma grade is calculated as the average grade of the results of the followings:

- Weighted average of the overall studies at the program (A)
- Average of grades of the thesis and its defense given by the Final Exam Board (B)
- Average of the grades received at the Final Exam for the two subjects (C)

Diploma grade = (A + B + C)/3

Classification of the award on the bases of the calculated average:

Excellent	4.81 – 5.00
Very good	4.51 – 4.80
Good	3.51 – 4.50
Satisfactory	2.51 – 3.50
Pass	2.00 – 2.50

Course Descriptions of Biology BSc Program

Title of course: Safety **Code**: TTKBE0711_EN	**ECTS Credit points:** 3
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - preparation for the tests: 62 hours Total: 90 hours	
Year, semester: 4th year, 1th semester	
Its prerequisite(s):TTKBE1112_EN	
Further courses built on it: -	

Topics of course

-General safety rules.
- Describing major accidents and causes.
- Poisoning, noise.
- Inerting of chemical vessels.
- Hazards of electricity (Static electricity, Direct current and alternating current)
- Dangers of chemical reactions.
- Safety valves, regulation of pressure, solutions in case of emergency.

Literature

Recommended:

1. D. A. Crowl, J.F. Louvar: Chemical Process Safety, Pearson, Boston, USA (2011)
2. Roger L. Bauer: Safety and Health for Engineers, Wiley Interscience, New York (2005)
3. Richard J. Lewis ed.: Sax1s Dangerous properties of Industrial Materials, John Wiley (2005)
4. C. D. Classen, Caserett and Doull's Toxicology, McGraw-Hill, New York (2008)

Schedule:

1st week

General and basic security rules. Definition of accident, near-miss (quasi-accident) and first aid. Can we learn from accidents that have not happened?

2nd week

Accident statistics, industry comparison. Conclusions from the figures.

3rd week

Some major accidents are described, for example: in Bhopal, India (1984), Seveso, Italy (1976), Red Sludge (Red Mud) Disaster, Kolontar, Hungary (2010). Discussion of the possible causes of accidents.

4th week

Intoxications. Exposure and elimination of toxic substances to the body. Basic principles of toxicology. Definition of LD50. Cross effects of toxic substances, antidotes. Methanol poisoning.

5th week
Definition and classification of noise. Effect of the frequency and power of the noise. Dangers and diseases caused by noise. Work in a noisy workplace.
6th week
Purpose and implementation of inerting. Nitrogen-Purging, Vacuum, Pressure, Combination and Siphon Method. Advantages disadvantages. Simplification of a simple oxygen concentration calculation method..
7th week
Dangers of static electricity. Prevention of the formation of static electricity. The dust explosion. Electrical hazards. The role of insulation, earthing, residual current device (fi-relay) and fuse in the prevention of accidents
8th week
Dangers of chemical reaction. Run-away reaction and possible causes. Exothermic and/or gas producing reactions. Pyrophoric, peroxide-forming, reacting with water, highly oxidizing, self-reactive, impact-sensitive, heat-decomposing materials and their dangers.
9th week
Types of safety valves and their operation. Multiple protection. Comparison of safety valves, advantages and disadvantages.
10th week
Removal of excess pressure in case of danger. Technical solutions. Protective devices and their use.
11th week
Identification of hazards (environmental and safety). Solution options. Explosion limits of gas mixtures. Options for security protection.
12th week
Watching educational videos on safety. Learn the GHS pictograms and safety signs.
13th week
Consultation.
14th week
Test for a recommended grade.

Requirements:
Attendance at lecturesis recommended, but not compulsory.
The course ends with test for a recommended grade. (This test is not compulsory!) The minimum requirement for the test is 50%. The grade is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-80	satisfactory (3)
81-90	good (4)
91-100	excellent (5)

The students can retake the test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. György Deák, associate professor, PhD

Lecturer: Dr. György Deák, associate professor, PhD

Title of course:Basic Environmental Sciences **Code**: TTTBE0040_EN	**ECTS Credit points: 1**

Type of teaching, contact hours

- lecture: 1 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 16 hours

Total: 30 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

What we call Environmental sciences. Natural values of the Earth, conservation of biodiversity. Effects of invasive species. Protection of habitats, prevention of species extinction. Short term and long term monitoring systems. Biomonitoring and MAB (Man and Biosphere programe). Fluvial and human transformed landscapes.

Literature

Compulsory:

H. Frances (2005): Global Environmental Issues. John Wiley & Sons, USA
ISBN: 978-0-470-09395-5
M. K. Wali, F. Evrendilek, M. S. Fennessy (2009): The Environment: Science, Issues, and Solutions. CRC Press ISBN: 9780849373879
J.M. Fryxell, A. R. E. Sinclair, G. Caughley (2014): Wildlife Ecology, Conservation, and Management. Wiley-Blackwell ISBN: 978-1-118-29106-1

Schedule:

1st week
Main parts of Environmental Siences, objects of Environmental Sciences
2nd week
Levels of living world.
3rd week
Basis of monitoring and biomonitoring systems
4th week
Levels of Ecology, ecological methods in environmental sciences
5th week
Ecological impacts of invasive plant and animal species in a changing world
6th week
Role of small habitat islands in human transformed landscapes – nature conservation, cultural andecosystem services
7th week
Biodiversity

8th week Indication *9th week* The world in maps *10th week* Rivers – fluival geomorfology *11th week* Sustainable development – World Conferences *12th week* Ecological footprint *13th week* Man and Biosphere program *14th week* Consultation or exam.
Requirements: *- for a signature* Attendance at lecturesis recommended, but not compulsory. *- for a grade* The course ends in an written examination. 2 (Pass) grade: 50% of the maximum points available. If the score of any test is below 50%, students can take a retake test. *-an offered grade:* There are at least two tests during the semester, and the offered grade is the average of them.
Person responsible for course: Dr. Sándor Alex Nagy,associateprofessor, PhD
Lecturer: Dr. István Gyulai, assistant professor, PhD

Title of course:Basics of Mathematics and Informatics **Code**: TTMBE0801_EN	**ECTS Credit points:** 2
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 32 hours Total: 60 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it:	
Topics of course	

Systems of linear equations. Basics of set theory, relations, functions. Continuous functions, limits of functions. Differentiability of function, differential calculus, analysis of differentiable functions. Indefinite integrals, rules of integration, Riemann-integral. Applications of integration. Differential equations. Basics of combinatorics. Introduction to probability theory, classical probability model, conditional probability, law of total probability. Random variables, distribution of random variables, discrete distributions, absolutely continuous distributions. Basic concepts of statistics, basic methods for statistical analysis.

Literature

Compulsory:
George B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano. Thomas's Calculus, 11th ed. Addison-Wesley, 2004.
Recommended:
Yeargers, Edward K., Herod, James V., Shonkweiler, Ronald W. An Introduction to the Mathematics of Biology: with Computer Algebra Models. Birkhauser, Boston, 1996.

Schedule:

1st week

Matrices, elementary matrix transformations, upper triangular matrices. Systems of linear equations, equivalent transformations of systems of linear equations. Gaussian elimination.

2nd week

Relations, domain and range of relations. Inverse relations, composition of relations. Equivalence relations, ordering relations. Functions, domain and range of functions. Inverse functions, composite functions. Elementary functions.

3rd week

Continuity of functions, continuity of elementary functions, operations and continuity of functions. Limits of functions. Limit at infinity, infinity as limit of a function. The connection between limit and continuity, limit and operations, and limit and ordering. Limits of composite functions.

4th week

The notion of differential quotient and derivative function. Geometric interpretation of the differential quotient. Connection between differentiability and continuity. Derivatives of elementary functions. Rules of differentiation.

5th week

Monotonicity of functions: necessary condition for monotonicity, necessary and sufficient condition for monotonicity. Extremal points, necessary condition of extremal points, sufficient condition of extremal points, general condition of extremal points. Analysis of differentiable functions. The L'Hospital rule.

6th week

Primitive function, indefinite integral. Basic integrals. Linearity of the integral. Partial integration, integration by substitution.

7th week

Darboux-sums, the notion of Riemann-integral of a function. Linearity of the Riemann-integral. Additivity of the Riemann-integral over intervals. The integral, as the function of the upper limit. The Newton-Leibnitz formula. Partial Riemann-integration, Riemann-integration by substitution.

8th week

Computing of area and arc length. Computing the area of the surface and the volume of solids of revolution.

9th week

The concept of differential equation. Differential equations of first order. Elementary types of differential equations: separable equations, linear differential equations of first order, exact differential equations.

10th week

Permutations, permutations with repetitions. Variations, variations with repetition. Combinations, combinations by repetition. Binomial coefficients, the binomial theorem.

11th week

Sample space, events, operations with events. Statistical explanation of the concept of probability. Probability space. Finite probability spaces. Classical probability space. Conditional probability, low of total probability. Bayes theorem. Independent events.

12th week

Discrete random variables, distribution of discrete random variables. Joint distribution. Independence. Expectation. Standard deviation. The most common discrete distributions.

13th week

Absolutely continuous random variable. Cumulative distribution function, probability density function. Expectation. Standard deviation. Most common absolutely continuous distributions.

14th week

Sample. Empirical distribution function. Sample mean, sample variance, sample mode, sample median, quantile.

Requirements:

- for a signature

If the student fails the course TTMBG0801_EN, then the signature is automatically denied.

- for a grade

The course ends in written examination, although it is possible to request an oral examination. The grade is given according to the following table:

Total Score (%)	**Grade**
0 – 50	fail (1)
51 – 60	pass (2)
61 – 75	satisfactory (3)
74 – 85	good (4)
86 – 100	excellent (5)

-an offered grade:

It is possible to obtain an offered grade on the basis of two written test during the semester. The grade is given according to the following table:

Total Score (%)	**Grade**
0 – 50	fail (1)
51 – 60	pass (2)
61 – 75	satisfactory (3)
74 – 85	good (4)
86 – 100	excellent (5)

Person responsible for course: Prof. Dr. Attila Bérczes, university professor, DSc

Lecturer: Prof. Dr. Attila Bérczes, university professor, DSc

Title of course:Basics of mathematics and informatics	**ECTS Credit points:** 3

Code: TTMBG0801_EN	

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it:

Topics of course

Systems of linear equations. Basics of set theory, relations, functions. Continuous functions, limits of functions. Differentiability of function, differential calculus, analysis of differentiable functions. Indefinite integrals, rules of integration, Riemann-integral. Applications of integration. Differential equations. Basics of combinatorics. Introduction to probability theory, classical probability model, conditional probability, law of total probability. Random variables, distribution of random variables, discrete distributions, absolutely continuous distributions. Basic concepts of statistics, basic methods for statistical analysis.

Literature

Compulsory:
George B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano. Thomas's Calculus, 11th ed. Addison-Wesley, 2004.
Recommended:
Yeargers, Edward K., Herod, James V., Shonkweiler, Ronald W. An Introduction to the Mathematics of Biology: with Computer Algebra Models. Birkhauser, Boston, 1996.

Schedule:

1st week

Exercises concerning matrices, elementary matrix transformations. Solving systems of linear equations by Gaussian elimination.

2nd week

Exercises concerning relations, domain and range of relations, inverse relations, composition of relations, equivalence relations, ordering relations. Exercises concerning functions (do-main and range, inverse functions, composite functions).

3rd week

Exercises concerning continuity of functions, and limits of functions (simple limits, limit at infinity, infinity as limit of a function).

4th week

Exercises concerning the derivative of functions.

5th week

Exercises concerning monotonicity of functions, extremal values of functions and the L'Hospital rule. Complete analysis of functions.

6th week

Exercises concerning primitive function, indefinite integral, partial integration, integration by substitution.

7th week

Exercises concerning Riemann-integrals, the Newton-Leibnitz formula, partial Riemann-integration and Riemann-integration by substitution.

8th week

Exercises concerning computing of area and arc length, and computing the area of the sur-face and the volume of solids of revolution.

9th week

Solving differential equations of special type (homogeneous, separable, linear, exact).

10th week

Solving basic exercises in combinatorics.

11th week

Solving exercises based on the classical probability model, conditional probability, low of total probability, Bayes theorem.

12th week

Exercises concerning discrete random variables.

13th week

Exercises concerning absolutely continuous random variables.

14th week

Solving basic exercises in the field of statistics.

Requirements:

- for a signature

Attendance of classes are compulsory with the possibility of missing at most three classes during the semester. In case of further absences, a medical certificate needs to be presented, otherwise the signature is denied.

- for a grade

The course is evaluated on the basis oftwo written tests during the end of the semester. The grade is given according to the following table:

Total Score (%)	**Grade**
0 – 50	fail (1)
51 – 60	pass (2)
61 – 75	satisfactory (3)
76 – 85	good (4)
86 – 100	excellent (5)

If a student fails to pass at first attempt, then a retake of the tests is possible.

-an offered grade:

It is not possible to obtain an offered grade in this course.

Person responsible for course: Prof. Dr. Attila Bérczes, university professor, DSc

Lecturer: Prof. Dr. Attila Bérczes, university professor, DSc

Title of course:Introduction to Chemistry **Code**: TTKBE0141_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam:62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: TTKBL0141_EN, Introduction to Chemistry (Parallel registration for both courses is required)

Topics of course

History and development of chemistry and its relation to other natural sciences. Basic definitions in chemistry: atoms, molecules, elements, compounds, mixtures, chemical symbols, chemical formulas, molar mass, chemical equations, the classification of chemical reactions. Development of atomic and molecular theory. The structure of atom. Basics of radioactivity. Discovery of the periodic table and periodically changing properties. Introduction to quantum chemistry. Primary and secondary chemical bonds. Description of gaseous, liquid and solid states of matter. Phase changes. Chemical equilibrium. Acid-base theories. Basics of thermochemistry, reaction kinetics and electrochemistry.

Literature

Compulsory:

- John McMurry – Robert C. Fay: Chemistry, 7th ed., Prentice Hall ISBN: 0321943171.
- Darrell D. Ebbing: General Chemistry, 9th ed. Belmont, CA, ISBN: 1-4390-4982-9
- James E. Brady, Gerard E. Humiston:General chemistry: principles and structure, 3rd ed., New York, Wiley,ISBN: 0471808164

Schedule:

1st week

Classification of natural sciences, history and development of chemistry. The concept of chemical change. The SI system of units, the most important physical quantities and units. Conservation of mass and energy. The law of definite proportions, the law of multiple proportions, law of combining gas volumes, Avogadro's law. Dalton's atomic theory. Relative atomic and molecular weights. Amount of substance and the definition of mole. Notations for elements and compounds, symbol, empirical formula, molecular formula.

2nd week

Valency and oxidation number. Oxidation number in inorganic compounds. Types of chemical reactions. Experimental background of the atomic theory, discovery of the nucleus. Discovery and basic properties of subatomic particles (electron, proton, neutron). Isotopes.

3rd week

Types and properties of radioactive radiation. Laws of radioactive decay, decay series. Medical and other practical importance of radioactive isotopes. The mass defect.Einstein's equation on mass-energy equivalence.Nuclear energy, nuclear fission and fusion. The Bohr model of the atom. Characteristics of electromagnetic radiation.

4th week

The dual nature of matter. Heisenberg's uncertainty principle. Schrödinger's equation and its application for the hydrogen atom. Quantum numbers and their importance. The shape of atomic orbitals. Principles of the periodic table.

5th week

Electronegativity, ionization energy, electronaffinity, atomic and ionic radii and their change across the periodic table.The ionic bond. Calculation of the lattice energy.Metallic bonding.

6th week

The covalent bond. Basic characteristics of the molecular orbital (MO) theory and its application for diatomic molecules. The valence shell electron pair repulsion (VSEPR) model. The shape of molecules, bond angles, bond orders. Polarity of covalent bonds, polar and nonpolar molecules.

7th week

Intermolecular forces. London forces, dipole-dipole interaction. Hydrogen bond and its importance in inorganic and organic chemistry. General characterization of molecular, ionic, metallic, and network atomic solids.

8th week

Classification and structure of chemical systems. General characterization of different states of matter. Gas laws: Boyle's law, Charles's law, the ideal gas law. Gas mixtures, partial pressure. General characterization of liquids, surface tension, viscosity. General characterization and classification of solids. Changes of state: melting, freezing, evaporation, condensation, sublimation.

9th week

Classification of multicomponent systems, properties of solutions and mixtures. Solubility and units of concentration. Vapor pressure, freezing and boiling point of solutions. Osmosis pressure. Determination of molecular weight. Phase diagrams, critical temperature and pressure. Thermodynamic temperature.

10th week

Basics of thermochemistry.Heat of reaction, Hess's law. The importance of heat of formation. Heat of reaction and bond energies. The direction of spontaneous chemical reactions: internal energy, enthalpy, free energy and entropy.

11th week

Dependence of reaction rates on concentrations and the temperature. Order of reactions. Activation energy. Catalysts, homogeneous and heterogeneous catalytic reactions. The equilibrium condition and the equilibrium constant. Possibilities to shift the composition of equilibria. Le Chatelier's principle.

12th week

Solubility equilibria, solubility product. Temperature dependence of solubility. Different theories of acid-base reactions (Arrhenius, Brønsted, Lewis). Characterization of aqueous

solutions, electrolytic dissociation. Strength of acids and bases. Dissociation constant and degree of dissocation.

13th week

Self-ionization of water. Ionic product of water. The definition and calculation of pH. Amphoteric substances. Buffer solutions and acid-base indicators. Acid-base properties of salts. Complex ion equilibria.

14th week

Basics of electrochemistry. Galvanic cells and the concept of electrode potential. Standard electrode potentials, oxidizing and reducing agents. Quantitative laws of electrolysis. Galvanic cells and batteries.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

- for a grade

The course ends in an **examination**. The result of the examination determines the final grade.

The minimum requirement for the examination is 50%. Based on the score of the exam, the grade is given according to the following table:

Score	Grade
0-49	fail (1)
50-62	pass (2)
63-75	satisfactory (3)
76-87	good (4)
88-100	excellent (5)

In case of failure, students can take retake exam(s) in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Gábor Bellér, assistant professor, PhD

Lecturer: Dr. Gábor Bellér, assistant professor, PhD

Title of course:Sampling, Sample treatment and Analytical tests **Code**: TTKBE0514_EN	**ECTS Credit points:** 1

Type of teaching, contact hours

- lecture: 1 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 16 hours

Total: 30 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The aim of the course is to introduce the sampling methods generally applied in environmental chemistry. The most important techniques for sampling soil, sediment, surface and underground water, gases, biotic and abiotic bioloical indicators, biological tissues and fluids, rocks and metal alloys will be discussed. All the relevant and most important pre-treatment techniques will be overviewed which are necessary to get rid of the matrix components prior to the quantitative and qualitative determination of organic and inorganic analytes (such as extraction and dilution techniques, atmospheric and microwave digestion, acidic and basic reactions under high pressure etc.). Sampling and sample pre-treatment methods will be discussed which are used for speciation analysis, for organometallic compounds and biomolecules.

Literature

Compulsory:

-Fundamentals of environmental sampling and analysis by Chunlong Zhang (ISBN: 978-0-471-71097-4)

Recommended:

- N.T. Crosby, I. Patel: General principles of good sampling practice, RSC,1995
- S. Mitra: Sample Preparation Techniques in Analytical Chemistry, Wiley, 2003.
- Sampling for Environmental Data Generation; P. Grieco and R. Trattner, SciTech Publishers, Matawan, NJ 1990.

-https://web.njit.edu/~kebbekus/analysis/SAMPLING.htm

Schedule: The lecture will be held in the first half of the semester, 2 hours/week

1st week

The grouping of environmental samples, sample types. The thematic classification of the most commonly measured components from environmental samples. The basic rules of sampling and the general description of sampling techniques.

2nd week

General statistical aspects of sampling. Liquid sampling: surface and underground water, rivers and streams. Solid sampling of metals, alloys and rocks. General guidelines, homogenization methods.

3rd week

Sampling from gases at atmospheric and high pressure. Direct sampling of solid materials from gaseous substances: aerosols and particulate matter (PM 10, PM 2.5). Adsorption and absorption techniques to selectively gain compounds from gaseous state, gas filtration. Sampling of soil, sediment and biological tissues.

4th week

Introduction to basic sample pre-treatment methods: homogenisation and drying of solid substances, circumstances affecting the solubility of the analyte. Storage, preservation and dissolving methods. Extraction techniques.

5th week

Reactions to eliminate the matrix and mobilize the compounds to be determined: dry and wet digestion methods, ignition, digestion at atmospheric pressure, microwave assisted sample pre-treatment. Digestion under acidic and basic conditions, most commonly applied reagents and pieces of equipment.

6th week

General introduction to the sampling and sample pre-treatment carried out for speciation analysis and organometallic substances, as well as biomolecules. Elemental speciation.

7th week

Sample preparation of biological indicators and biological tissues, fluids. Exact examples of a complex sampling and sample pre-treatment process, discussing the steps of tasks to be carried out. Review and consultation possibility.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory. However, students attending 5 out of the 7 occasions will have the opportunity to write a written test after the last lecture: if it is successful **a grade will be offered** in the electronic system which can be accepted or denied by the student.

- for a grade

The course ends in an **examination**. The students will either successfully fulfil the requirements to write the written test for an offered grade or take an oral exam in the examination period.

The minimum requirement for the passing mark in the written test and the examination respectively is 50%. For the written test to gain the offered grade the following table will be applied to calculate the result:

Score	Grade
0-49	fail (1)
50-65	pass (2)
66-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of the written test is below 50, students can take the oral exam in the examination period which is the same for those students not visiting the lectures regularly.The exam is in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-for an offered grade

Please see above highlighted with bold characters.

Person responsible for course: Dr. Edina Baranyai, assistant professor, PhD

Lecturer: Dr. Edina Baranyai, assistant professor, PhD

Dr. Gábor Bellér, assistant professor, PhD

Title of course:Sampling, Sample treatment and analytical tests **Code**: TTKBL0514_EN	**ECTS Credit points:** 4

Type of teaching, contact hours

- lecture: -
- practice: -
- laboratory: 4 hours/week

Evaluation: mid-semester grade based on laboratory manual and written test

Workload (estimated), divided into contact hours:

- lecture: -
- practice: -

- laboratory: 56 hours
- home assignment: 64 hours
- preparation for the exam: -

Total: 120 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): ?

Further courses built on it: ?

Topics of course

During the laboratory practice, the complex environmental assessment of a fishing lake will be carried out. Taken plant, water, soil and sediment samples will be analysed with the studied methods for the most important inorganic contaminants: chemical oxygen demand, cations and anions affecting halobity, dissolved oxygen, oxygen saturation, pH, conductivity, elemental composition. Both on site techniques, as well as classical and instrumental methods will be applied.

Literature

Compulsory:
- Fundamentals of environmental sampling and analysis by Chunlong Zhang (ISBN: 978-0-471-71097-4)
- University syllabus of environmental analysis (available at the Department's home page of inorg.unideb.hu)

Recommended:
- Sampling for Environmental Data Generation; P. Grieco and R. Trattner, SciTech Publishers, Matawan, NJ 1990.
-https://web.njit.edu/~kebbekus/analysis/SAMPLING.htm

Schedule: The third occasion will be a whole day (8 hours) of sampling at a fishing lake which therefore equals with two practical occasions (2*4 hours).

1st week

Introduction to the general laboratory safety rules highlighting the safety considerations of on-site field study. Overview of the laboratory and on-site pieces of equipment and instruments.

2nd week

Introduction to the fishing lake to be sampled. The sample types to be taken and the compounds to be measured will be discussed, the analytical methods to be applied for the quantitative analysis will be chosen. Students will build up the sampling plan, make a map, indicate the sampling points and collect all the sampling tools from the laboratory which will be necessary to carry out the sampling and on-site measurements.

3rd week (2 4 hours)*

A full day trip to the fishing lake where the collection of surface water, sediment, soil and plant samples will be carried out. On site measurements of water pH and electric conductivity, temperature, preservation of samples for elemental analysis as well as the titration for dissolved oxygen and chemical oxygen demand will be carried out. Samples will be then taken to the laboratory for further measurements.

4th week

Determination of cation (macro and micro elements) concentration of the surface water samples by microwave plasma atomic emission spectrometry (MP-AES). Dilution of standard solutions and calibration required for the quantitative measurements.

5th week

Determination of the anion concentration affecting halobity from surface water samples by classical analytical and instrumental methods: carbonate and hydrogen carbonate ion by acid-base titration, chloride ion by argentometric titration and sulphate ion by spectrophotometric analysis.

6th week

Grinding and drying of soil samples, homogenization. Determination of the moisture content and organic matter content of soil samples and preparing them for elemental analysis by microwave assisted wet digestion at elevated pressure.

7th week

The elemental analysis of soil samples by microwave plasma atomic emission spectrometry (MP-AES). Dilution of standard solutions and calibration required for the quantitative measurements.

8th week

Grinding and drying of plant samples, homogenization. Determination of the moisture content of plant samples and preparing them for elemental analysis by conventional wet digestion at atmospheric pressure.

9th week

The elemental analysis of plant samples by microwave plasma atomic emission spectrometry (MP-AES). Dilution of standard solutions and calibration required for the quantitative measurements.

10th week

Cutting, grinding and drying of sediment samples, homogenization. Determination of the moisture content and organic matter content of sediment samples and preparing them for elemental analysis by microwave assisted wet digestion at elevated pressure.

11th week

The elemental analysis of sediment samples by microwave plasma atomic emission spectrometry (MP-AES). Dilution of standard solutions and calibration required for the quantitative measurements.

12th week

Evaluation of the gained results – calculating the final concentration results from the primer data of samples.

13th week

Written test regarding the field and laboratory work of sampling, sample pre-treatment and analysis of important environmental factors. Discussion of statistical analysis for the final evaluation and interpretation of the gained data. Finishing the laboratory manuals to be handled in. Washing up all the sample containers and pieces of equipment.

Requirements:

- for a signature

Attendance at **both the field study and laboratory practices are obligatory.** Maximum one occasion can be missed but only along with a medical certificate. The written test must be above 20% to get a signature, otherwise the student will receive a signature denied and must take the course again in the next semester.

- for a grade

The course ends in a written test. The minimum requirement for the passing mark in the written test is 50%. For calculating the grade of the test the following table will be applied:

Score	Grade
0-49	fail (1)
50-65	pass (2)
66-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of the written test is below 50, students can take one final exam in the examination period, which will be similar to the written test.The exam is in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Students will also handle in an electronic laboratory manual interpreting the overall results of the complex environmental assessment of the fishing lake. Grade will be given to this laboratory manual as well.

Final grade will be formed by taking the average of the results of the written test (or exam) and the laboratory manual.

-for an offered grade

no grade will be offered

Person responsible for course: Dr. Edina Baranyai, assistant professor, PhD

Lecturer: Dr. Edina Baranyai, assistant professor, PhD
Dr. István Gyulai, assistant professor, PhD

Title of course:Basic Geology **Code**: TTGBG5103_EN	**ECTS Credit points: 2**

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The aim of the course is to introduce the basic of geological sciences to the students. During the course basics of crystallography (unit cells, crystal system, main types of crystal lattices, principal physical features), mineralogy (main rock-forming minerals and mineral raw materials) and petrography (system and nomenclature, main igneous, sedimentary and metamorphic rock types) will be discussed. In the second half of the course the basic fields and principles of physical geology are discussed including global tectonics, lithostratigraphy and biostratigraphy. The most import events of the history of the Earth are also discussed from the Archaic to present times.

Literature

Compulsory:
- K.W. Hamblin – E.H. Christiansen: Earth's dynamic system (10th edition). Prentice Hall, ISBN 978-0131420663
- Z. Püspöki (ed): Chapter from Geology. Kossuth University Press, Debrecen, 2005.
- T.H. Torsvik – L.R.M. Cocks: Earth history and palaeogeography – Cambridge University Press, 2016

Recommended:
- A. Bishop – A. Wolley – W. Hamilton: Guide to minerals, rocks and fossils. Firefly Pocket Series, 2005. ISBN 1-55407-054-6

Schedule:

1st week

Definition of crystals, minerals, rocks. The concept and types of unit cell. Crystal system (triclinic, monoclinic, orthorhombic, tetragonal, trigonal, hexagonal, cubic).

2nd week

Crystal lattices, ionic lattices, covalent bonding lattices, metallic bonding lattices. Basic physical features of crystals (hardness, optical features).

3rd week

Test 1

4th week

Chemical and genetic system of minerals. Native element minerals; sulphides; oxides and hydroxides; silicates; sulphates; phosphates; carbonates, nitrates and borates; halogenides; organic minerals.

5th week

Nomenclature and system of rocks. Main types of igneous, sedimentary and metamorphic rocks.

6th week

Test 2

7th week

CONSULTATION WEEK

8th week

The interior structure of the Earth. Plate tectonics and structural geology. Diverging and converging plates and the processes along their margins. Rifting and mid-oceanic ridges.

9th week

Most important processes of subduction and the structure and development of volcanic island-arc systems. Orogenesis and the formation of cratons. Magma generation zones, the formation of igneous rocks in the different stages of plate tectonics.

The basic fields of stratigraphy (lithostratigraphy, biostratigraphy, chronostratigraphy).

10th week

The principles of stratigraphy (uniformitarianism, actualism, horizontality, deposition). Dollo's law, Walther's facies principles. The chronostratigraphic chart, relative and absolute age determination methods.

11th week

Test 3.

12th week

History of the Earth in general. Detailed history of the Earth over the Precambrian (formation of the crust together with the initiation of plate tectonic processes, formation and composition of the primary and the ancient atmosphere, occurrence of life and its early development, increasing earth crust via plate tectonic processes). Development of flora and fauna in the Palaeozoic. Plants and animals invading dry terrains.

13th week

Development of the crust, the flora and fauna over the Mesozoic and the Cenozoic. Alpine orogenic cycle, focusing on the formation of Europe. Dominant plants and animals in the Mesozoic. Development of microfauna in Mesozoic and early Cenozoic marine environments. History of mammals over the Mesozoic and Cenozoic.

14th week

Test 4

Requirements:

- *for a signature*

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can't make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

During the semester there are four tests: the first in the 3rd, the second in the 6th, the third in the 11th and the fourth one in the 14th week. Students have to sit for the tests

- *for a grade*

The practice grade is calculated as an average of the results of the four tests.

The minimum requirement for each testis 50%.The grade is given according to the following table:

Score	Grade
0-49	fail (1)
50-64	pass (2)
65-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Péter Rózsa, associate professor, PhD

Lecturer: Dr. Péter Rózsa, associate professor, PhD;
Dr. Richard William McIntosh, assistant professor, PhD

Title of course: Fundamentals of Biology	**ECTS Credit points:** 3

Code: TTBBE1010_EN	

Type of teaching, contact hours

- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 62 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 1st year, 1st semester

Its prerequisite(s):-

Further courses built on it:-

Topics of course

Concept of Biology. Criteria of Life. Fundamentals of Taxonomy. Tree of Life. Levels of Organization. Concept of the cell. Comparison of procaryote and eucaryote cell. The endosymbiosis theory. Comparison animal and plant cell. Biogenic and abiogenic component in living organism. Biogenic elements. Water and its biological importance. Osmosis and diffusion. Colloid systems. Biological importance of lipids. Carbohydrates and its biological importance..Amino acids. Structure and function of proteins. Nucleotides. Nuklein acids. Structure and function of DNA. Chromosomes. Concept and types of mutation. Mutagenics. Types of RNA in cell. Metbolism in cell. Enzymes as byocatalyzers. Place and process of photosyntesis in cell. Biosynthesis of nucleic acids. Genetic code. Central dogma of molecular biology. Genes. Gene regulation. Protein synthesis. Carbohydrate catabolism.
Cytoplasm. Membranes in cell. Membrane tarnsport in cell. Nucleus and citocentrum.
Cell cycle. Mitosis and meiosis.

Literature

Compulsory:

- Sedava, D., Hillis, D. M., Heller, H. C., Berenbaum, M. R. (2012): Life. The Science of Biology. Sinauer Associates, Sunderland,USA.

Recommended:

- Ville, C. A., Martin, C. E., Berg, L, R., Davis P. W. (2008): Biology. Saunders College Publishing, Philadelphia

Schedule:

1st week

Concept of Biology. Criteria of Life.

2nd week

Levels of Organization

3rd week

Fundamentals of Taxonomy. Tree of Life

4th week

The endosymbiosis theory. Comparison animal and plant cell.

5th week

Concept of the cell. Comparison of procaryote and eucaryote cell.

6th week

Biogenic and abiogenic component in living organism. Biogenic elements. Water and its biological importance.

7th week

Osmosis and diffusion. Colloid systems.

8th week

Biological importance of lipids.
Carbohydrates and its biological importance..

9th week

Amino acids. Structure and function of proteins.

10th week

Nucleotides.
Nuklein acids. Structure and function of DNA. Chromosomes.

11th week

Concept and types of mutation. Mutagenics. Types of RNA in cell.

12th week

Metbolism in cell. Enzymes as byocatalyzers. Place and process of photosyntesis in cell. Carbohydrate catabolism.

13th week

Biosynthesis of nucleic acids. Genetic code. Central dogma of molecular biology. Genes. Gene regulation. Protein synthesis.

14th week Cytoplasm. Membranes in cell. Membrane tarnsport in cell. Nucleus and citocentrum. Cell cycle. Mitosis and meiosis.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

- for a grade

The course ends in awritten (essay with ten question) **examination (**colloquium). Based on the average of the grades of the designing questions, the exam grade is calculated as an average of them:

- the average grade of the ten designing tasks
- the result of the examination

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tasks separately, the grade for the essay and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any essay is below 60, students can take a retake tessay in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the average grade of written examination is at least satisfactory (3) The offered grade is the average of them.
Person responsible for course: Dr. Ibolya Markóczi Revák associate professor, PhD
Lecturer: Dr. Ibolya Markóczi Revák, associate professor, PhD

Title of course: Chemical Basis of Biology **Code**: TTBBE1005_EN	**ECTS Credit points:** 2
Type of teaching, contact hours - lecture: 1 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 30 hours Total: 44 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

The students will acquire the basics of organic chemistry and will get acquainted with the structure and properties of biological macromolecules and their building blocks.

Literature

Compulsory:
- P. Gergely (2014): Organic and bioorganic chemistry for medical students, Debrecen University Press, ISBN 9789633181478

Recommended:
- F. A. Carey (2000): Organic Chemistry, McGraw-Hill (2000), 2016. ISBN 0-07-290501-8
- P. Gergely (2014): Introduction to bioinorganic chemistry for medical students, Debrecen University Press, ISBN 9789633180105

Course objective/intended learning outcomes

a) Knowledge
- He/she knows the basic principles and terms of organic chemistry.

- He/she knows the industrially and biologically important compounds, their structures, physical and chemical properties.
- He/she can use the obtained knowledge in the course of their biochemistry studies.

b) Abilities

- He/she is able to apply the obtained knowledge to solve simple problems of organic chemistry.
- He/she is able to understand the basic concepts behind news in the media concerning chemistry related research.
- He/she is able to express an opinion on chemistry related topics.

c) Attitude

- He/she is open to learn and use the new methods of bioorganic chemistry.
- He/she is open to self-education.
- He/she aspires to understand and reveal concepts and correlations.
- He/she is committed, inquisitive and motivated.

d) Autonomy and responsibility

He/she is cooperative, responsible and open-minded.
He/she is ready to deal with chemistry related problems alone and in a team as well.
He/she feels responsibility for other people's work during research and cooperative studies.
He/she feels it is their duty to take responsibility and participate actively in a team's work to achieve the goals they aim for.

Schedule:

1st week

Introduction. Relationship of organic chemistry with biochemistry and molecular biology. Carbon-carbon bonds. Allotropic forms of carbon. Carbon-heteroatom bonds. Classification of organic compounds. Electron distribution in organic compounds. Chemical reactions in organic chemistry.

2nd week

Hydrocarbons. Saturated hydrocarbons (alkanes). Saturated cyclic hydrocarbons (cycloalkanes). Chemical reactions of saturated hydrocarbons. Unsaturated hydrocarbons (alkenes and alkynes). Nomenclature. Constitutional and geometric isomers. The conformation. Radical substitution reactions. Reactions of the carbon-carbon double bond. Conjugated polyenes. Structure and bonding of acetylene. Isoprenes and terpenes.

3rd week

Aromatic compounds. Structure and bonding of benzene. Aromaticity. Isomerism of aromatic compounds. Groups derived from aromatic structures. Overview of aromatic compounds. Benzene and its homologues. Aromatic heterocycles with five and six membered rings. Chemical reactions of aromatic compounds. Electrophilic aromatic substitution. Substituent effects in electrophilic aromatic substitution. Organic halogen compounds. Synthesis and reactions of organic halogen compounds. Nucleophilic substitution and elimination reactions. Important halogenated compounds.

4th week

Alcohols and phenols. Classification of alcohols and phenols. Physical properties of alcohols and phenols. Hydrogen bonding. Synthesis and chemical properties of alcohols and phenols. Important alcohols and phenols. Synthesis, properties and important representatives of ethers.

5th week

Sulfur containing organic compounds: thiols and thioethers. Aldehydes and ketones. Nomenclature, physical properties and synthesis of aldehydes and ketones. Reactions of the carbonyl group. Nucleophilic additions, condensations, oxidation and reduction reactions. Keto and enol tautomers, aldol addition and condensation. Important aldehydes and ketones. Quinones.

6th week

Nitrogen-containing organic compounds. Physical properties and synthesis of amines. Chemical properties of amines: basicity and reactions. Aliphatic and aromatic amines. Biologically important amines.

7th week

Carboxylic acids. Nomenclature and physical properties. Preparation and chemical properties of carboxylic acids. Important mono- and dicarboxylic acids. Natural hydroxy- and oxocarboxylic acids. Carboxylic acid derivatives. Synthesis and hydrolysis of esters. Saponification and deacylation. Thioesters. Carboxylic acid anhydrides, acyl halides and amides. Derivatives of carbonic acid.

8th week

Mid-term test (topics of weeks 1-7).

9th week

Stereochemistry. Symmetry of simple carbon compounds. Properties of chiral compounds. Central chirality. Properties of enantiomers. Optical activity. Absolute and relative configurations. Molecules with more than one stereocenters. Separation of enantiomers.

10th week

Amino acids. Structure and classification of amino acids. Acid-base behaviour of amino acids. Reactions of amino acids. Peptides and proteins. The peptide bond. General properties and classification of proteins. Structure of proteins (primary, secondary, tertiary and quaternary).

11th week

Carbohydrates 1. Monosaccharides. Aldoses and ketoses. The cyclic structure of monosaccharides (hemiacetal, anomers, pyranose and furanose forms, epimers). Conformations of monosaccharides. Glycosides. Common monosaccharides.

12th week

Carbohydrates 2. Reducing and non-reducing disaccharides. Structure of important disaccharides. Oligosaccharides and polysaccharides.

13th week

Lipids. Classes of lipids. Biological functions of lipids. Fats, oils, glycerophospholipids. The structure of biological membranes. Nucleosides, nucleotides and polynucleotides. Chemical structure of DNA and RNA.

14th week

End-term test (topics of weeks 9-13).

Requirements:

Attending the lectures is recommended but not compulsory.

There are two mandatory written tests during the semester according to the schedule. The average score of the two tests is calculated, and the offered grade is given according to the following table:

Score	Grade
0-49	fail (1)
50-60	pass (2)
61-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

Examination
Students may accept the offered grade based on the results of the mid-term and end-term test, otherwise the course ends in a written exam. The grade is given according to the table above.

Person responsible for the course: Dr. János Kerékgyártó, senior research fellow

Lecturer: Dr. Sándor Kun, research fellow

Title of course: Chemical Basis of Biology **Code**: TTBBG2035_EN	**ECTS Credit points:** 3

Type of teaching, contact hours
- lecture:-
- practice:-
- laboratory: 2 hours/week

Evaluation: practical exam

Workload (estimated), divided into contact hours:
- lecture: -
- practice: -
- laboratory: 28 hours
- home assignment: 14 hours
- preparation for the exam: 14 hours

Total: 56 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):-

Further courses built on it:-

Topics of course

The students will acquire the basics of organic chemistry and will get acquainted with the structure and properties of biological macromolecules and their building blocks.

Literature

Compulsory:

- Switzer, R. and Garrity L.: Experimental biochemistry. Theory and exercises in fundamental methods, Third edition **;** W.H. Freeman and Company New park; (1999**)** ISBN: 0-7167-3300-5 (EAN: 9780716733003)

Recommended:
- F. A. Carey (2000): Organic Chemistry, McGraw-Hill (2000), 2016. ISBN 0-07-290501-8
- P. Gergely (2014): Organic and bioorganic chemistry for medical students, Debrecen University Press, ISBN 9789633181478

Course objective/intended learning outcomes

a) Knowledge
- He/she knows the basic principles and terms of organic chemistry.
- He/she knows the industrially and biologically important compounds, their structures, physical and chemical properties.
- He/she can use the obtained knowledge in the course of their biochemistry studies.

b) Abilities
- He/she is able to apply the obtained knowledge to solve simple problems of organic chemistry.
- He/she is able to understand the basic concepts behind news in the media concerning chemistry related research.
- He/she is able to express an opinion on chemistry related topics.

c) Attitude
- He/she is open to learn and use the new methods of bioorganic chemistry.
- He/she is open to self-education.
- He/she aspires to understand and reveal concepts and correlations.
- He/she is committed, inquisitive and motivated.

d) Autonomy and responsibility
He/she is cooperative, responsible and open-minded.
He/she is ready to deal with chemistry related problems alone and in a team as well.
He/she feels responsibility for other people's work during research and cooperative studies.
He/she feels it is their duty to take responsibility and participate actively in a team's work to achieve the goals they aim for.

Schedule:

1st week
Laboratory techniques and safety instructions.

2nd week
*Amino acids, peptides, proteins seminar***. Amino acids. The structure and the classification of amino acids. Stereochemistry. Chemical reactions of amino acids. Peptides and proteins. Primary, secondary, tertiary, quaternary structures. Test reactions.**

3rd week
Amino acids, peptides, proteins practice. Chemical tests of proteins and amino acids: Biuret test, Xanthoproteic test, Millon's test. Thin-layer chromatography of amino acids.

4th week
Amino acids, peptides, proteins practice. Chemical tests of proteins and amino acids: ninhydrin test, sulfur test, heavy-metal ions test. Protein coagulation tests: effect of heat, alcohol, nitric acid.

5th week
Purification of proteins practice. Dialysis, gel-filtration chromatography. Quantitative determination of proteins by means of photometry.

6th week

Carbohydrates seminar. Carbohydrates. Monosaccharides, aldoses, ketoses, pentoses, hexoses. Stereochemistry of carbohydrates. Ring structure of monosaccharides. Conformation of pyranose and furanose rings.

7th week
Carbohydrates practice. Characterization reactions of carbohydrates: Molisch test, Bial's test, Seliwanoff's test. Thin-layer chromatography of carbohydrates.

8th week
Carbohydrates seminar. Disaccharides, reducing and nonreducing disaccharides. Polysaccharides.

9th week
Carbohydrates practice. Investigation of reducing and nonreducing disaccharides and starch. Fehling's test, hydrolysis test.

10th week
Vitamines seminar. Biological and chemical properties of water and fat soluble vitamines. The structure and reducing properties of vitamine C.

11th week
Vitamines practice. Quantitative determination of vitamin C content of juices and plant samples.

12th week
Nucleotides, Nucleic acids seminar. Structures of nucleotides, nucleic acids.

13th week
Nucleotides, Nucleic acids practice. Experiments with RNA. Hydrolysis of yeast RNA. Test reactions for building units of RNA. Quantitative determination of phosphorus content by means of photometry.

14th week

Semester closing papers

Requirements:

- for a signature

Participation at practice classes is **compulsory**. A student must attend the practice classes and may not miss during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. In case of further absences, a medical certificate needs to be presented.

- for a grade

The course ends in practical test. The minimum requirement for the end-term tests respectively is 60%. The grade for the tests is given according to the following table:

Score	Grade
0-49	fail (1)
50-60	pass (2)
61-74	satisfactory (3)
75-87	good (4)
88-100	excellent (5)

Person responsible for the course: Dr. János Kerékgyártó, senior research fellow

Lecturer: Dr. János Kerékgyártó, senior research fellow

Title of course: **Biostatistics** **Code**: TTBBE1001_EN	**ECTS Credit points: 2+1**
Type of teaching, contact hours - lecture: 2 hours/week - practice: 1 hours/week - laboratory: 0 hours/week	
Evaluation: practical grade	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: 14 hours - laboratory: 0 hours - home assignment: 28 hours - preparation for the exam: 30 hours Total: 100 hours	
Year, semester: 1st year, 1 st semester	
Its prerequisite(s): Course objective/intended learning outcomes a) knowledge - Has a designer and management level knowledge on the theories, paradigm, ideas and principles of environmental sciences. - Has the basic knowledge about biology, physics, geological sciences, chemistry, mathematics and informatics which is necessary for an effective work in the field of such a multi-disciplinary science as environmental sciences. - Has knowledge on the possibilities regarding the utilisation and protection of resources from spheres on the Earth's surface or near to the Earth's surface. - Has knowledge on the spatial relations of the environmental processes on micro-, meso- and macro-region level. - Has a knowledge and a critical approach regarding the effects of medical, judicial and safety regulations on the environment and on the society. - Has a knowledge on the management level solutions for problems occurring in the fields of environmental protection, nature conservation, industrial, medical and self-government. b) ability - Able to critically evaluate theories and principles in the light of the changing natural environment and social environment. - Through multidisciplinary thinking, able to understand the direct and indirect relationships of environmental science using the information available from the subdisciplines of environmental science.	

- Able to recognise and identify the properties of the materials and phenomena involved in environmental science, and able to characterise them by the measures of environmental science both in the nm and km size range, both in space and time.
- Able to work independently as a designer, manager and expert in workplaces dealing with scientific research in environment and nature conservation. Able to work effectively in workplaces adapting the results of environmental sciences such as research institutes and administration.
- Able to engage in the tasks of industry, agriculture and forestry, water, health, and local government.
- Able to independently solve tasks requiring environmental education in nature and environment.
- Able to design and implement environmental impact assessments and evaluate the results in accordance with domestic and EU requirements and standards.
- Has a wide range of problem-solving skills set by environmental problems.
- Able to interpret articles in a foreign language, which are related to the field of environmental science and able to process them on an independently elaborated basis.

c) attitude
- Positively interested in continuative education in environmental science.
- Makes efforts to reach the widest possible understanding of processes in the spheres located on the Earth's surface or near its surface.
- Make efforts to get acquainted with the new achievements of the disciplines of environmental science and to synthesize them.
- Has the necessary abilities for designing, conducting and evaluating practical activities related to the examination of each sphere.
- Make efforts to carry out its tasks related to environmental problems in co-operation with his/hers colleagues, taking into account their professional opinion.
- Make efforts to develop co-operation with representatives of other scientific fields in environmental studies.
- Sensitive to the environmental and natural problems and crises both on a local and global scale.
- Environmental awareness, love of nature, and commitment to the sustainable development guide and shape his/hers lifestyle and actions.

d) autonomy and responsibility
- By his/hers initiatory and decision-making ability, personal responsibility he/she is able for a constructive co-operation in teamwork, even for managing teams.
- Takes responsibility for his/hers decisions regarding environmental issues.
- During professional activities, he/she studies with responsibility the environmental risks of anthropogenic processes and according to his best knowledge, directs the necessary actions to reduce them.
- He/she can independently evaluate the professional literature related to any field of environmental science, even in a foreign language.
- Independently carries out practical research tasks related to any field of the environment and takes responsibility for them.
- Can carry out independent planning, management and expert tasks in workplaces for scientific research in environmental sciences, in research and development institutes and in the administration of environmental sciences.

Further courses built on it:

Topics of course

A comprehensive introduction to probability, probability distributions, sampling distributions, basic techniques of statistical inference, analysis of variance, linear regression, inference for categorical variables, and nonparametric statistics. This course is designed to teach the students about a variety of mathematical methods which are used in modelling through their application to solving hydrobiological problems. In the practical part of the course students learn the methods of mathematical methods of data processing and planning of experiment.

Literature

Venables, W. N. and Ripley, B. D. 2003: Modern Applied Statistics with S. 4th edition. Springer, New York.

Cox D.R., Donnelly C.A. (2011): Principles of Applied Statistics Cambridge University Press

Wasserman L. (2004): All of Statistics: A Concise Course in Statistical Inference, Springer;

Course objective/intended learning outcomes

A comprehensive introduction to probability, probability distributions, sampling distributions, basic techniques of statistical inference, analysis of variance, linear regression, inference for categorical variables, and nonparametric statistics. This course is designed to teach the students about a variety of mathematical methods which are used in modelling through their application to solving hydrobiological problems. In the practical part of the course students learn the methods of mathematical methods of data processing and planning of experiment.

Schedule:

1st week Introduction to the course

2nd week Basics of model building in science.

3rd week Introduction to the programming languages, with special reference to R programming language end environment.

4th week Basics of data management.

5th week Graphical methods in descriptive statistics.

6th week Basic statistics; statistical distributions

7th week Exam

8th week Sampling, design of experiments.

9th week Regression analyses.

10th week Analysis of variance (ANOVA).

11th week . General linear models and generalized linear models.

12th week.Multivariate methods: classification.

13th week. Multivariate methods: ordination.

14th week Exam

Requirements:

Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there are two tests: the mid-term test in the 7th week and the end-term test in the 14th week.

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

-an offered grade:

it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

- in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to have an exam in the exam session.

Person responsible for course: Dr. Béla Tóthmérész
Lecturer: Dr. Béla Tóthmérész

Title of course:Plant anatomy **Code**: TTBBE2001_EN, TTBBL2001_EN	**ECTS Credit points: 2+4**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: 3 hours/week	
Evaluation: examination + mid-semester grade for laboratory classes	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: 42 hours - home assignment: 54 hours - preparation for the exam: 54 hours Total: 180 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: Plant Physiology	

Topics of course

Regarding lectures:
The course involves chapters from plant cell biology, discussing the characteristic plant cell compartments such as plastids, cell wall and vacuoles. It presents the cell types of different plant tissues.It involves the anatomy of primary organs and the study of the secondary tissues in roots and trunks (emphasizing the importance of secondary xylem and phloem) as well. Morphology elicits the amazing diversity of structures and forms of plants. Beside the above topics, the course is guiding students through the life cycles and the different reproduction forms in the kingdom of plants. Emphasis is placed on evolutionary trends and on the fact that all plant structures are the result of the natural selection.

Regarding laboratory practice:
During the practicals the students study plant cell structures, tissues, and their appearance and arrangement in the different organs by light microscopy. Different forms of plant organs are studied by taking typical plants representing different evolutionary complexity. All these experimental approaches serve the better understanding of the topics of the lectures.

Literature

Compulsory:

- Mauseth, J., D. 2003/2010: Botany, An introduction to plant biology, Saunders College Publishing, Philadelphia Fort Worth Chicago San Francisco Montreal Toronto London Sydney Tokyo.
- Peterson, R.L., Peterson, C.A., Melville, L.H. 2008: Teaching plant anatomy through creative laboratory exercises. NRC Press, Ottawa/ON

Recommended:

- Beck, C.B. 2005/2010: Plant structure and development. CUP, Cambridge, UK
- Cutler, D.F., Botha, T., Stevenson, D.W. 2008: Plant anatomy-an applied approach. Malden, MA., USA

Schedule:

*1st week***Lecture (L)**: Survey of the topics discussed during the semester. What is a plant? Life cycles in the plant kingdom.

Laboratory (Lab): Basic methods in the study of plant morphology and anatomy- a survey.

*2nd week***L:** Life cycles in Gymnosperms and Angiosperms.

Lab: Leaf, stem and root morphology.

*3rd week***L:** Reproductive structures in flowering plants: the flower.

Lab: Flower morphology.

*4th week***L:** Reproductive structures in flowering plants: the fruit and seed.

Lab: Fruit, seed and seedling morphology.

*5th week***L:** General features of eukaryotic and among them, plant cells.

Lab: Students will learn microscope usage.

6th week **L:** The plastid system of plants. Types of chloroplasts. Structure and functions of chloroplasts.

Lab: Examination of chloroplasts, chromoplasts and etioplasts as well as of pigmented vacuoles.

*7th week***L:** The plant cell wall: formation, structure and functions.

Lab: Microscopic examination of the types of plant cell wall thickening I.

*8th week***L:** The vacuolar system in plants: biogenesis, structure of tonoplasts and functions.

Lab: Microscopic examination of the types of plant cell wall thickening II.

*9th week***L:** Types of plant tissues: a survey. The meristematic tissue: characterization of its cells, types of meristems.

Lab: Microscopic examination of different meristematic tissues.

*10th week***L:** Primary differentiated tissues.Epidermal tissues: types of epidermis and their cell types. Ground tissues: types, with special emphasis on assimilatory and mechanical tissues. Vascular tissues: types- the xylem and phloem, structure and functioning of the vessel elements and sieve tubes.

Lab: Microscopic examination of several characteristic cells of epidermal, ground and vascular tissues.

*11th week***L:** Primary and secondary structure of root.

Lab: Microscopic examination of primary root structures of dicots and monocots as well as several characteristic secondary structures of dicots (e.g. in *Taraxacum officinale*).

*12th week***L:** Primary and secondary structure of stem.

Lab: Microscopic examination of primary stem structures of dicots and monocots as well as several characteristic secondary structures of dicots (e.g. in *Aristolochia, Sambucus* and *Tilia*).

*13th week***L:** Types of leaves according to their structure and their histology. Structure-function relationships in leaves.

Lab: Microscopic examination of characteristic dorsiventral and homogenous leaves as well as of the characteristic leaf structure in Gymnosperms (*Pinus*).

*14th week***L/Lab:** Discussion/survey of the topics treated on lectures and laboratory classes.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade

The course ends in an **examination** in case of the lecture. As for **laboratory classes**, there will be three tests during the semester and the mark for laboratory classes will be the average of these tests and the activity of the student as recorded in their notebooks.

The minimum requirement for both the examination and laboratory grade is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

Person responsible for course: Dr. Márta M-Hamvas, associate professor, PhD, Dr. Csaba Máthé, associate professor, PhD
Lecturer: Dr. Csaba Máthé, associate professor, PhD

Title of course: Plant Taxonomy lecture **Code**: TTBBE2005_EN	**ECTS Credit points: 3**
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: - - laboratory: - - home assignment: - - preparation for the exam: 62 hours Total: 90 hours	
Year, semester: 1st year, 1st semester	
Its prerequisite(s): -	
Further courses built on it: -	

Topics of course

Topic, basic terms and history of Plant Taxonomy. Serial Endosymbiont Theory (SET). Origin and taxonomy of significant divisions of algae (Cyanobacteria, Glauco-, Rhodo-, Heterokonto-, Hapto-, Crypto-, Dino-, Eugleno-, Chlorarachnio- és Chlorophyta), of bryophytes (Anthocero-, Hepatico-, Bryophyta), of ferns and allies (Lycopodio-, Monilophyta) and of gymnosperms (Cycado-, Ginkgo- Gneto- és Coniferophyta). Molecular cladistics of major angiosperm taxa (paleoherb, monocot, eudicot). Evolutionary links and practical significance of the most important orders and families of angiosperms.

Literature

Compulsory:

APG 2003.An update of the Angiosperm Phylogeny Group classfication for the orders and families of flowering plants : APG II. *Bot. Journal of the Linnean Society 141: 399-436.*

Schedule:

1st week Delineation of the term's schedule. A brief history of plant taxonomy (plant systematics) (folk systems, taxonomists of the antiquity, Middle Ages: scolastics, doctrine of signatures, herbals, taxonomists of the modern history, artificial taxonomic systems: Linnaeus and followers, natural systems after Linnaeus, evolutionary systems, numerical taxonomy, morphological cladistics, molecular cladistics).

2nd week Topic and basic terms of plant systematics (taxonomy, hierarchic classification, identification, binominal nomenclature, taxon, descriptio, diagnosis, concept of priority, synonimy, homonimy, tautonimy, type (typus), holotype, isotype, *International Code of Botanical Nomenclature*, artificial vs. natural systems,

sources of taxonomic information (citotaxonomy, hibridisation, mechanisms of isolation, concept os species and subspecies, polytipic species, autofertility, pieces of geobotanical information).

3rd week Origin of the eucaryotic cell, SET. Algae I. (Cyanobacteria, Glaucophyta, Rhodophyta, Heterokontophyta and Haptophyta).

4th week Algae II. (Cryptophyta, Dinophyta, Euglenophyta, Chlorarachniophyta, Chlorophyta and some of its significant classes as Chloro-, Ulvo-, Cladophoro-, Zygnemato- and Charophyceae)

5th week Taxonomic position of lichens and bryophytes. Evolutionary links among bryophyte divisions (Anthocerophyta, Hepaticophyta, Bryophyta). Their morphology and diversity.

*6th week*Origin of Polysporangiophytes (interpolation and transformation theory), their diversification (telome and enation theories), challenges and solutions: morphological and functional consequencies of land life. Major fossile taxa among ferns and fern allies Taxonomic position of their extant taxa (Lycopodiophyta:Lycopodiales, Isoetales, Selaginellales, Monilophyta: Ophioglossopsida,Psilopsida, Equisetopsida, Marattiopsida, Polypodiopsida).

7th week Origin and phylogenetic links of gymnosperms. Selected fossile taxa (Progymnospermopsida, Pteridospermales, Glossopterales) and extant representatives in Cycadophyta *(Zamia, Cycas)*, Ginkgophyta *(Ginkgo)*, Gnetophyta *(Gnetum, Ephedra, Welwitschia*) and in Coniferophyta*: Cordaites, Woltzia;* Pinaceae. Araucariaceae, Podocarpaceae, Sciadopytiaceae, Cephalotaxaceae, Taxaceae, Cupressaceae). Morphological traits, diversity, evolutionary and practical significance. Mid-term consultation, discussion of test examples.

8th week Evolutionary age and origin of angiosperms, some selected fossile taxa of angiosperms (Pteridospermales: *Sanmiguelia, Furcula, Caytonia, Umkomasia, Pteruchus*, ancient angiosperms: *Ficophyllum, Acaciaephyllum, Archaeofructus, Caloda, Lesqueria, Archaeanthus*). Recent assessment of the 'monocot' and 'dicot' concept (paleoherb, monocot, eudicot). The paleoherb clade (Amborellales,Nymphaeales, Austrobaileyales, Ceratophyllales, Chloranthales, Magnoliales, Laurales, Canellales, Piperales).

9th week Evolutionary position of the monocot clade and that of the commelinid subclade. Morphological and biochemical synapomorphies. Acorales,Alismatales,Dioscoreales,Pandanales, Liliales, Asparagales,Arecales,Zingiberales/Commelinales,Poales.

*10th week*Basal eudicot and basal core eudicot clades. Basal eudicots (Ranunculales, Proteales). Basal core eudicots (Gunnerales, Dilleniales, Caryophyllales, Santalales, Saxifragales, Vitales)

11th week The rosid clade. Basal orders of rosids (Geraniales, Myrtales). Eurosid I. = fabid clade (first orders) (Zygophyllales,Malpighiales, Oxalidales, Fabales, Rosales).

*12th week*Eurosid I. = fabid clade (second group of orders) (Cucurbitales,Fagales), eurosid II. – malvid clade (Brassicales, Malvales, Sapindales).

*13th week*Morphological synapomorphies of the asterid clade. Basal orders of the asterids (Cornales, Ericales). The euasterid I. = lamiid clade with late sympetaly (Garryales, Gentianales, Boraginales, Lamiales, Solanales)

14th week The euasterid II. – campanulid clade with early sympetaly (Aquifoliales, Apiales, Dipsacales, Asterales). Incertae sedis (Balanophoraceae, Rafflesiaceae). Review of exam requirements, demonstration and discussion of a full test example.

Requirements:

- for a signature
Attendance at **lectures** is recommended, but not compulsory.

No test during the semester but there is mid-term discussion (7th week) which includes consultation possibility of test examples in topics covered till that time.

- for a grade
The course ends in an **examination**.

The minimum requirement for the test is 50%.Based on the score of the exam test the grade for the examination is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-69	satisfactory (3)
70-79	good (4)
80-100	excellent (5)

Person responsible for course: Dr. Matus Gábor, associate professor, PhD

Lecturer: Dr. Matus Gábor, associate professor, PhD

Title of course:Plant Taxonomy practical **Code**: TTBBL2005_EN	**ECTS Credit points: 2**

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation:

Workload (estimated), divided into contact hours:

- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 62 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): Plant Taxonomy lecture, Plant Anatomy practical and lecture

Further courses built on it: -

Topics of course

The aim of the course is to get an overview on the diversity of selected taxonomical groups of plants. Our goal is to get a clear morphological delimitation of some significant natural plant families in angiosperms and some higher ranked taxa in other divisions. Selection of taxa includes both representatives of the Central European flora and those of the students' home country. A total of ca. 400 taxa will be covered in form of independent data collection and seminar discussion.

Learning the critical usage of electronic as well as printed sources is also aimed. This knowledge enables studenst to conduct activities that require a basic level of practical taxonomic knowledge. A set of sources which help students to improve this knowledge is also discussed.

Literature

Recommended in print:
Király, G. et al. (eds.) (2009, 2011) New Hungarian Herbal The vascular plants of Hungray. Identification key. Illustrations (Új magyar füvészkönyv. Magyarország hajtásos növényei.) I.-II. Aggteleki Nemzeti Park Igazgatóság, Jósvafő pp. 675.

Recommended sites:
http://www.mobot.org
http://www.efloras.org (recently updated regions include North America, China, Chile, Nepal and several other regions for selected taxa).
http://www.tropicos.org/
http://ec.europa.eu/environment/nature/conservation/species/redlist/plants/acknowledgements.htm
http://www.hlasek.com
http://caliban.mpiz-koeln.mpg.de/thome/index.html

Schedule:

*1st week*Requirements and way of presentaions discussed. Review of recommended literature in print and on the web. Native and cultivated gymnosperms in Central Europe.
*2nd week*Gymnosperms native and cultivated to the students' home countries. Ferns and fern allies in Central Europe. Visit to the herbarium (Soó and Siroki collections of DE, Department of Botany).

*3rd week*Ferns and fern allies in the students' home countriees. Woody flora in Central Europe.

*4th week*Woody species in the students' home countries. Poaceae in Central Europe.

*5th week*Poaceae in the students' home countries. Cyperaceae, Juncaceae, Sparganiaceae and Typhaceae in Central Europe.

*6th week*Cyperaceae, Juncaceae, Sparganiaceae, Typhaceae in the students' home countries.Nymphaeaceae, Aristolochiaceae, Magnoliaceae, Ranunculaceae and Papaveraceae in Central Europe.

7th week Nymphaeaceae, Aristolochiaceae, Magnoliaceae, Ranunculaceae and Papaveraceae in the students' home countries.Completion of missing or delayed presentations.

*8th week*Discussion on presentations in first half of term. Crassulaceae, Saxifragaceae, Haloragaceae, Grossulariaceae, Rosaceae in Central Europe.

*9th week*Crassulaceae, Saxifragaceae, Haloragaceae, Grossulariaceae, Rosaceae in the students' home countries. Fabaceae (incl. Mimosaceae, Caesalpiniaceae) in Central Europe.

*10th week*Fabaceae (incl. Mimosaceae, Caesalpiniaceae) in the students' home countries. Asclepiadaceae, Apocynaceae, Lamiaceae, Lentibulariaceae, Orobanchaceae, Plantaginaceae, Scrophulariaceae, Solanaceae, Convolvulaceae and Boraginaceae in Central Europe.

*11th week*Asclepiadaceae, Apocynaceae, Lamiaceae, Lentibulariaceae, Orobanchaceae, Plantaginaceae, Scrophulariaceae, Solanaceae, Convolvulaceae and Boraginaceae in the students' home countries. Plumbaginaceae, Polygonaceae, Caryophyllaceae, Amaranthaceae, Phytolaccaceae, Portulacaceae, Euphorbiaceae, Hypericaceae, Violaceae, Cannabaceae, Urticaceae, Cucurbitaceae**,** Brassicaceae, Resedaceae, Cistaceae, Malvaceae in Central Europe.

*12th week*Plumbaginaceae, Polygonaceae, Caryophyllaceae, Amaranthaceae, Phytolaccaceae, Portulacaceae, Euphorbiaceae, Hypericaceae, Violaceae, Cannabaceae, Urticaceae, Cucurbitaceae**,** Brassicaceae, Resedaceae, Cistaceae, Malvaceae in the students' home countries. Euasterid II. (Lorathaceae, Viscaceae, Primulaceae, Ericaceae, Campanulaceae, Asteraceae) in Central Europe.

*13th week*Euasterid II. in the students' home countries. Visit to the Botanic Garden of the Debrecen University.

*14th week*Completion of missing or delayed presentations. Closing remarks and discussion on marks.

Requirements:

- for a signature

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor.

Each students have to **submit 7 presentations in a term** which practically means that every student has to compile a presentation in every second week and in every practical half of the students is going to give a presentation in front of his/her fellow students. Attendance of practice classes when a given student has not a presentation is also compulsory.

Presentations in a each topic should include five species native to or cultivated in the student's home country. It should cover the taxonomic position, morphology, habitat preference, conservational and practical significance of selected species. Species selection is free within the formerly designated taxonomic group. It should be prepared and submitted via e-mail at least 24 hours before the beginning of the next practice. Preferred formats for the presentation are *ppt* (not *pptx*) and *pdf.*

- for a grade

The minimum requirement for each submission material is 50%.Based on the average of submitted presentationsthe mark is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-69	satisfactory (3)
70-79	good (4)
80-100	excellent (5)

If the score of any test is below 50, students can take a retake test two times during the term in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Gábor Matus, associate professor, PhD

Lecturer: Dr. Gábor Matus, associate professor, PhD

Title of course: Zoology I **Code**: TTBBE2010_EN	**ECTS Credit points: 2**

Type of teaching, contact hours

- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

Introduction to the taxonomy, ontogeny, phylogeny and anatomy of Porifera, Placozoa, Cnidaria, Ctenophora, Acoelomorpha, Lophotrochozoa and Ecdysozoa.

Literature

Recommended:

R. C., Brusca, W., Moore & M., Schuster: Invertebrates. Massachusetts, Sinauer Associated. Inc, Publishers, 2016

Schedule:

1st week

General introduction to the taxonomy, ontogeny, phylogeny, physiology and anatomy of animals

2nd week

Protista

3rd week

Parazoa, Porifera

4th week

Placozoa, Cnidaria, Ctenophora

5th week

Acoelomorpha, Lophotrochozoa, Gnathostomulida, Cycliophora, Gastrotricha, Acanthocephala, Rotifera

6th week

Platyhelminthes, Mesozoa, Entoprocta, Bryozoa, Phoronozoa, Brachiozoa

7th week

Nemertea, Mollusca, Annelida, Sipunculida

8th week
Ecdysozoa (except for Arthropoda)
9th week
Generalintroduction to Arthropoda
10th week
Trilobita, Chelicerata
11th week
Myriapoda
12th week
Crustacea I: Remipedia, Cephalocarida, Branchiopoda, Maxillopoda, Ostracoda
13th week
Crustacea II: Malacostraca
14th week
Insecta

Requirements:
- for a signature
Attendance at **lectures** is recommended, but not compulsory.
- for a grade
Grade based on written examination at the end of the semester.

Person responsible for course: Dr. András Tartally, associate professor

Lecturer: Dr. Jácint Tökölyi, associate professor,
Dr. Edit Juhász, senior lecturer,
Dr. András Tartally, associate professor.

Title of course: Animal Anatomy **Code**: TTBBL2030_EN	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: mid-semester tests

Workload (estimated), divided into contact hours:
- lecture:
- practice: -
- laboratory: 28 hours
- home assignment: 32 hours
- preparation for the exam: -
Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

The students will learn the fundamentals of anatomy, the inter-multi- and transdisciplinary nature of anatomy, the basic concepts of anatomy, as well as the general and global questions and problems of anatomy, as well as the connection between science policy and practical activity in anatomy within the framework of the practical classes of animal anatomy. The students will be prepared for the critical processing of problems and phenomena within the scope of biology.

Literature

Recommended:

R. C., Brusca, W., Moore & M.,Schuster: Invertebrates. Massachusetts, Sinauer Associated. Inc, Publishers, 2016

Schedule:

1. week: Application of the terminology of anatomy, systems of anatomical planes. The most important anatomical abbreviations. Protozoa (*Protista*) showing animal behavioural properties. Organizational structure (reproduction, nutrition) of the Giant amoeba (*Amoeba proteus*) and the Paramecium (*Paramecium caudatum*).

2. week: Sponges (*Porifera*) as animals with pseudo-tissues and *Cnidaria* as the first ancient representatives of animals true tissues. The common hydra (*Hydra vulgaris*). The life functionalities of the three types of sponges (Ascon, Sycon, Leucon).

3. week: Introduction to flatworms (*Plathyhelminthes*), mourning planaria (*Planaria lugubris*). The nematode (*Nematoda*) group. Pig roundworm (*Ascaris suum*). Its organizational structure, evolutionary significance.

4. week: Segmented worms (*Annelida*) and the common earthworms (*Lumbricus terrestris*). Leeches (*Hirudinea*) and body structure of the medical leech (*Hirudo medicinalis*). The practical importance of both species, their ecological functions.

5. week: Mollusca (*Mollusca*) and mussels (*Bivalvia*). Body structures of the snails (*Gastropoda*) and mussels (*Bivalvia*). and their ecological roles.

6. week: Arthropods (*Arthopoda*). Insects (*Insecta*), the organizational structure of a cockroach species. The economic importance as a forest pests and population decline in specific areas in Europe and Hungary.

7. week: The importance of vertebrates as the most complex organisms among animals. The importance of fishes (*Pisces*). Carps (*Cyriniformes*): body structure, integument, digestive system, circulatory system, excretory system, reproductive system, nervous system and sensory organs.

8. week: The skeletal system of fish. The structure and role of the skull, the vertebral column and the ligaments.

9. week: Amphibians (*Amphibia*, tailless amphibians (*Anura*). The integument, digestive system, respiratory system, urogenital system, circulatory system, nervous system and sensory organs of the edible frog (*Rana esculenta*).

10. week: The skeletal system of amphibians. The cranium, spinal column, girdle, limbs. Muscular system.

11. week: The body structure of birds (*Aves*), focusing on galliforms (*Galliformes*). The body structure, plumage, feather types of the domestic fowl (*Gallus domesticus*). The digestive system, the respiratory system, the circulatory system, the reproductive system, the urinary system. The structural elements and role of the egg. The nervous system and the senses. The skeletal system of birds. The skull, spinal column, ribs, sternum, shoulder girdle and pelvic girdle. System of free limbs.

12. week: Body structure of mammals (*Mammalia*). The organizational structure of Rodents (*Rodentia*) and of the albino rat (*Epimus norvegicus var albino*). Alimentary canal, excretory system, reproductive organs, nervous system, sensory organs. The skeletal system of mammals, the structure of the axial skeleton and the limb skeleton (Appendicular skeleton). Structure, parts and characteristics of the viscerocranium and the brain skull (Neurocranium).

Requirements:
- for a grade
Grade based on mid-semester tests.

Person responsible for course: Dr. Edit Juhász, senior lecturer

Lecturer: Dr. Edit Juhász, senior lecturer

Title of course:Zoology II **Code**: TTBBE2015_EN	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
  - home assignment: 32 hours
  - preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): TTBBE2010_EN

Further courses built on it: -

Topics of course

Introduction to Deuterostomes. Echinoderms. Hemichordates. Chordates: Urochordates, Cephalochordates and Vertebrates. General characterization of vertebrates. Agnathans. Cartilaginous fishes. Ray-finned fishes. Sarcopterygians and the origin of tetrapods. Amphibians and adaptations to land. General characterization of amniotes. Sauropsida I: turtles (Testudines). Snakes and lizards (Lepidosauria). Sauropsida II: crocodiles and alligators (Crocodilia). Radiation of mesozoic diapsids. Birds (Aves): evolution, diversity and characterization; Mammals (Mammalia): evolution, diversity and characterization.

Literature

Recommended:

F. Harvey Pough, Christine M. Janis, John B. Heiser: Vertebrate Life, Pearson Education, 2013.

Schedule:

1st week

Introduction to Deuterostomes. Echinoderms. Hemichordates

2nd week

Chordates: Urochordates, Cephalochordates and Vertebrates.

3rd week

General characterization of vertebrates. Agnathans.

4th week

Cartilaginous fishes.

5th week

Ray-finned fishes.

6th week

Sarcopterygians and the origin of tetrapods.

7th week

Amphibians and adaptations to land.

8th week

General characterization of amniotes. Sauropsida I: turtles (Testudines).

9th week

Snakes and lizards (Lepidosauria).

10th week

Sauropsida II: crocodiles and alligators (Crocodilia). Radiation of mesozoic diapsids.

11th week

Birds (Aves): their evolutionary origins

12th week

Birds (Aves): their diversity and characterization;

13th week

Mammals (Mammalia): their evolutionary origins.

14th week

Mammals (Mammalia): their diversity and characterization.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

- for a grade

Grade based on written examination at the end of the semester.

Person responsible for course: Dr. Jácint Tökölyi

Lecturer: Dr. Jácint Tökölyi

Title of course:Animal taxonomy I **Code**: TTBBL2020_EN	**ECTS Credit points: 3**

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: -
- practice: 28 hours
- laboratory: -
  - home assignment: 62 hours
  - preparation for the exam: -

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s):

Further courses built on it:

Topics of course

Introduction to the zootaxonomy, the knowledge and identifiaction of the practically most important groups and sepcies of: Crustacea, Myriapoda, Chelicerata and Hexapoda.

Literature

Recommended:

The up-to-date taxonomic keys of the certain groups (given at the course).

Schedule:

1st week

Crustacea

2nd week

Myriapoda

3rd week

Chelicerata

4th week

Parainsecta, Blattodea,Mantodea,Orthoptera, Dermaptera, Phasmatodea

5th week

Embioptera,Zoraptera,Psocoptera, Hemiptera, Phthiraptera

6th week

Coleoptera I

7th week

Coleoptera II, Strepsiptera

8th week

Odonata,Ephemeroptera, Plecoptera,Neuropteroidea, Mecoptera, Trichoptera, Thysanoptera, Megaloptera

9th week

Lepidoptera I

10th week

Lepidoptera II

11th week

Hymenoptera I

12th week

Hymenoptera II

13th week

Diptera I

14th week

Diptera II, Siphonaptera

Requirements:

- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence.

- for a grade

During the semester there will be tests week-by-week. Students have to sit for the tests. The minimum requirement for each of the tests is 60%. The grade is calculated as an average of the tests. The grade for the tests is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)

90-100	excellent (5)

Person responsible for course: Dr. András Tartally, senior lecturer, PhD

Lecturer: Dr. András Tartally, senior lecturer, PhD

Title of course: Animal taxonomy II **Code**: TTBBL2025_EN	**ECTS Credit points: 3**

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: -
- practice: 28 hours
- laboratory: -
  - home assignment: 62 hours
  - preparation for the exam: -

Total: 90 hours

Year, semester: 2nd year, 2nd semester

Its prerequisite(s):

Further courses built on it:

Topics of course

Introduction to the zootaxonomy, the knowledge and identifiaction of the practically most important groups and sepcies of: Porifera, Cnidaria, Platyhelminthes, Nemertinea, Nematoda, Nematomorpha, Rotatoria, Annelida, Mollusca, Pisces, Amphibia, „Reptilia", „Aves" and Mammalia.

Literature

Recommended:

The up-to-date taxonomic keys of the certain groups (given at the course).

Schedule:

1st week

Porifera, Cnidaria, Platyhelminthes

2nd week

Nemertinea,Nematoda, Nematomorpha

3rd week

Rotatoria, Annelida

4th week

Mollusca

5th week

Pisces I

6th week
Pisces II
7th week
AmphibiaI
8th week
Amphibia II
9th week
„Reptilia" I
10th week
„Reptilia" II
11th week
„Aves" I
12th week
„Aves" II
13th week
MammaliaI
14th week
MammaliaII

Requirements:

- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student cannot make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence.

- for a grade

During the semester there will be tests week-by-week. Students have to sit for the tests. The minimum requirement for each of the tests is 60%. The grade is calculated as an average of the tests. The grade for the tests is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. András Tartally, senior lecturer, PhD

Lecturer: Dr. András Tartally, senior lecturer, PhD

Title of course:Cell biology **Code**: TTBBE2045_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: 2 hours/week
- practice: -

- laboratory: shared with the TTBBL3001-EN

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment:
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The series of lectures are based on the topics of cellular structure and function. It reviews the theories describing the abiotic origin of life. After that it deals with the cellular membrane systems, compartmentalisation, transport processes and describes the properties of cellular organs on the morphological and molecular level. The lectures are strongly focusing on the explanation of basic cellbiological principles and terminology to gain massive fundamentals for the upcoming courses.

Literature

Compulsory:

- Gerald Karp: Cell Biology, 6th.Ed. John Wiley and Sons, 2010

Recommended literature will be given on every lecture, and can be accessed online.

Schedule:

1st week

General properties of the living systems

Cellular-theory, Chemoton-model, abiogenesis, chemical evolution, ribozymes, molecules of information

2nd week

Cellular membranes

Composition and formation of cellular and endomembrane systems.

3rd week

Cellular membrane transport

Transport systems and transport energetics.

4th week

Prokaryotic and eukaryotic cells

Functional and morphological comparison of pro- and eukaryotic cells.

5th week

Cytoskeleton and motorproteins

Cellular dynamics and involved proteins.

6th week

Vesicular systems and lysosomes

Vesicular processes and transport.

7th week

1. **Midterm exam**

8th week

Biology of the cellular organelles

Basic function and morphology of the cellular organelles.

9th week

Mitochondrial function and energy metabolism

Basic cellular metabolism and bioenergetics.

10th week

Cellular signalling pathways

Signal transduction, receptors and ligands, second messengers.

11th week

The nucleus

Nuclear structure and functions, chromatin structure.

12th week

Cell-cycle regulation and pathology

Normal and pathological processes involved in the regulation of cell-cycle.

13th week

Cellular experimental and investigation methods

Basic methods in cell-biology.

14th week

2. **Midterm exam**

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

During the semester there are two tests: mid-term tests in the 8th week and in the 15th week. Students have to sit for the tests.

- for a grade

Based on the grades of the mid-term tests, the final grade is calculated as an average of them. The course ends in an **examination if mid-term test results are not reaching 60% each**.

The minimum requirement for the mid-term and examination test respectively is 60%. Based on the score of the tests separately, the grade for the tests **or** the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of **exam** test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the average grade of the two mid-termtest is at least pass (2) and the mid-term tests reach 60% each.

Person responsible for course: Dr. Szemán-Nagy Gábor, senior lecturer, PhD

Lecturer: Dr. Szemán-Nagy Gábor, senior lecturer, PhD

Title of course:Cell biology **Code**: TTBBG2045_EN	**ECTS Credit points:** 2

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: shared with the TTBBL3001-EN

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The series of lectures are based on the topics of cellular structure and function. It reviews the theories describing the abiotic origin of life. After that it deals with the cellular membrane systems, compartmentalisation, transport processes and describes the properties of cellular organs on the morphological and molecular level. The lectures are strongly focusing on the explanation of basic cellbiological principles and terminology to gain massive fundamentals for the upcoming courses.

Literature

Compulsory:

- Gerald Karp: Cell Biology, 6th.Ed. John Wiley and Sons, 2010

Recommended literature will be given on every lecture, and can be accessed online.

Schedule:

1st week

General properties of the living systems

Cellular-theory, Chemoton-model, abiogenesis, chemical evolution, ribozymes, molecules of information

2nd week

Cellular membranes

Composition and formation of cellular and endomembrane systems.

3rd week

Cellular membrane transport

Transport systems and transport energetics.

4th week

Prokaryotic and eukaryotic cells

Functional and morphological comparison of pro- and eukaryotic cells.

5th week

Cytoskeleton and motorproteins

Cellular dynamics and involved proteins.

6th week

Vesicular systems and lysosomes

Vesicular processes and transport.

7th week

1. **Midterm exam**

8th week

Biology of the cellular organelles

Basic function and morphology of the cellular organelles.

9th week

Mitochondrial function and energy metabolism

Basic cellular metabolism and bioenergetics.

10th week

Cellular signalling pathways

Signal transduction, receptors and ligands, second messengers.

11th week

The nucleus

Nuclear structure and functions, chromatin structure.

12th week

Cell-cycle regulation and pathology

Normal and pathological processes involved in the regulation of cell-cycle.

13th week

Cellular experimental and investigation methods

Basic methods in cell-biology.

14th week

2. **Midterm exam**

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory. A Power Point presentation (10 relevant slide) about a selected topic.

During the semester there are two tests: mid-term tests in the 8th week and in the 15th week. Students have to sit for the tests.

- for a grade

Based on the grades of the mid-term tests, the final grade is calculated as an average of them. The course ends in an **examination if mid-term test results are not reaching 60% each**.

The minimum requirement for the mid-term and examination test respectively is 60%. Based on the score of the tests separately, the grade for the tests **or** the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of **exam** test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:
it may be offered for students if the average grade of the two mid-termtest is at least pass (2) and the mid-term tests reach 60% each.

Person responsible for course: Dr. Szemán-Nagy Gábor, senior lecturer, PhD

Lecturer: Dr. Szemán-Nagy Gábor, senior lecturer, PhD

Title of course:Bioinformatics **Code**: TTBBE2060_EN	**ECTS Credit points: 2**

Type of teaching, contact hours
- lecture: 1 hour/week
- seminar: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 14 hours
- seminar: -
- laboratory: -
- home assignment: -
- preparation for the exam: 46 hours

Total: 60 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Introduction to bioinformatics. The course includes: a general introduction, methods of genome sequencing, genome projects, sequence assemblers, structural and functional annotation of genome sequences, cluster analysis, basic principles of molecular phylogenetics, phenetics and cladistics, distance-based and character-based strategies, UPGMA and WPGMA,

neighbor-joining analysis, maximum parsimony analysis, maximum likelyhood analysis and Bayesian methods

Literature

Recommended:
Barnes M.R. and Gray, I.C.: Bioinformatics for Geneticists, Wiley, Chichester, 2013

Schedule:

1st week
Introduction to bioinformatics
2nd week
Methods of genome sequencing and the genome projects
3rd week
Sequence assemblers
4th week
Structural and functional annotation of genome sequences.
5th week
Cluster analysis
6th week
Basic principles of molecular phylogenetics
7th week
Phenetics and cladistics
8th week
Distance-based and character-based strategies
9th week
PGMA methods: UPGMA and WPGMA
10th week
Neighbor-joining analysis
11th week
Maximum parsimony analysis
12th week
Maximum likelyhood analysis
13th week
Bayesion methods
14th week
End-of-semester consultation

Requirements:
Attendance at lecturesis recommended, but not compulsory.

Attendance at seminars is compulsory.

During the semester, there are two tests: in the 6th week and in the 10th week. Students have to sit for the tests but the results of the tests are not taken into consideration at the end-of-semester examination.

Semester ends with examination and signature.

Examination (lectures):

The end-of-semester examination is based on the lectures, no additional reading is required. The students answer questions is the standard assay form. No time limit is set for writing the answers. Each answer is evaluated individually using the standard five-grade system. The final examination grade is the average of the individual grades. If necessary, students can also be examined orally.

Signature (seminar):

Signature is given for the attendance at seminars. More than three absences are not permitted.

Person responsible for course: Prof. Dr. Sipiczki Matyas, emeritus professor, DSc

Lecturer: Prof. Dr. Sipiczki Matyas, emeritus professor, DSc

Title of course: Bioinformatics **Code**: TTBBG2060_EN	**ECTS Credit points:** 2

Type of teaching, contact hours

- lecture: -
- practice:2 hours/week
- laboratory: -

Evaluation: practical exam

Workload (estimated), divided into contact hours:

- lecture: -
- practice: 28 hours in blocks
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 2nd semester

Its prerequisite(s):-

Further courses built on it:-

Topics of course

Finding scientific journals, citations: Pubmed, Medline, Scopus, Agricola. Getting to know NCBI. Genetic diseases in humans and animals: OMIM, OMIA. Database of Hazardous Substances: NCBI-TOXNET.
Identification of DNA and Protein Sequences: ENTREZ, ENSEMBL, GeneDB, Yeastgenome, Pombase Databases. Sequence analysis: Protein and DNA BLAST, pairwise alignment, multiple alignment and phylogenetic trees. Learn about the Treeview program. Design and control of PCR primers. Restriction digestions, restriction endonucleases. Learn about bioinformatics.org.

Literature

Compulsory:-
Recommended:-

Requirements:

- for a signature
Participation at practice classes is **compulsory**. A student must attend the practice classes and may not miss during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. In case of further absences, a medical certificate needs to be presented.

Students are allowed to bring and use their own notebook computer.

- for a grade
The course ends in practical test.

The minimum requirement for the end-term tests respectively is 60%. The grade for the tests is given according to the following table:

Score	Grade
0-9	fail (1)
10-11	pass (2)
12-13	satisfactory (3)
14-15	good (4)
16-17	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:-

Person responsible for course: Dr. Hajnalka Csoma, assistant professor, PhD

Lecturer: Dr. Hajnalka Csoma, assistant professor, PhD

Title of course:Animal physiology I **Code**: TTBBE3001_EN	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 2nd semester

Its prerequisite(s):

Further courses built on it: TTBBG3001_EN

Topics of course

To provide the students with the necessary amount of knowledge (both theoretical and practical) which allows them to fully understand the physiological activity of the animal and human body and the most important regulatory mechanisms governing its function.

Topics: Homeostasis. Extra- and intracellular fluids. Buffer systems of body. Oxygen transfer. Clotting. Physiology of blood, heart, circulatory, respiratory and alimentary systems. Hormonal and neural regulation of circulatory, respiratory and alimentary systems.

Literature

Compulsory:

Knut Schmidt-Nielsen: Animal physiology, Cambridge University Press, 1997.
Eckert: Animal physiology. Mechanisms and adaptations. W.H. Freeman and Company, 1998.
Christopher D. Moyes, Patricia M. Schulte: Principles of animal physiology.Pearson Education In c. 2008.

Schedule:

1st week Homeostasis. Extra- and intracellular fluids. Fluid compartments of body. Special extracellular fluids. Transports across cellular membrane

2nd week Blood circulation systems: open and closed circulation. Types of heart pumps. Fish, Amphibia, Reptile circulation systems. Arteriosus and venous pressure in standingand prone positions. Birds and Mammals circulatory systems.

3rd week Circulatory systems. Flow of fluid between capillaries and cells. Blood supply of organs. Different parts of blood vessels. Main arteries and veins of organs. Circulatory systems of fetus and newborn

4th week Functionof heart. Histological and physiological characteristics of cardiac muscle. Pulmonary and systemic circuit. Coronary artery. Adaptation to high altitudes. Conducting pathway of heart. Cardiac adaptation. Cronotrophic, dromotrophic, inotrophic and bathmotrophic effects on heart.Hormonal and neuronal regulation of heart.

5th week Oxygen transport. The structure and oxygen equilibrium curve of hemoglobin and myoglobin. Oxygen affinity depending of Hb to temperature, pH and 2,3-bisphosphoglycerate. CO affinity to Hb. Methemoglobin. Blood clotting. Extrinsic and intrinsic way. Coagulation factor. Fibrin network formation, effect of thrombin in blood clotting. Fibrinolysis.

6th week **Mid-term test.** Homeostasis, evolution of circulatory system, parts of heart and regulation of movement of heart. Blood cells, oxygen carrying of blood. Mechanism of coagulation.

7th week Mechanics of respiration. Upper and lower part of respiratory system. Lung volumes and capacities. Disorders of pulmonary gas exchange. Gas exchange across surface of alveoli, role of surface tension. Respiratory movements and their regulation. Respiration in air, water: gill, lung, trachea. Dissolving and diffusion of gases in water. Gas exchange and flow of water across gill. Diffuse and ventilation lung. Respiratory movements. Regulation of respiratory.

8th week Energy metabolism, nutrition, thermal regulation. Nutrient: carbohydrates, lipids, proteins. Liquid nutrients. Parasites, symbioticnutrition. Thermal equilibrium, centre and periphery temperature, fever.

9th week Digestion. Gut motoric and secretory locomotions. Comparison of different animal groups based on theirnutrition and digestion methods.

10th week The human stomach and digestive organs of gastrointestinal tract. Digestive enzymes. Function of pancreas. Regulation of enzyme production.

11th week Transport. Surfaces for transport of nutrients. Function of liver. Production of bile, its composition and function.

12th week The three main mechanisms of locomotion(amoeboid, ciliary, muscle). Smooth, cardiac and striated muscle. Molecular mechanism of muscle contraction.

13th week Discussion of the topics treated on lectures.

14th week **2. End-term test.**Types and regulation of respiration. Types and regulation of digestion. Types of muscles and locomotion; mechanisms of muscle contraction.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Students have to **submit all the two designing tasks** as scheduled minimum on a sufficient level.

During the semester there are two tests: the mid-term test in the 6th week and the end-term test in the 14th week. Students have to sit for the tests

- for a grade

The course ends in an **examination**. Based on the average of the grades of the designing tasks and the examination, the exam grade is calculated as an average of them:

- the average grade of the two designing tasks
- the result of the examination

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

Person responsible for course: Dr. Zsuzsa Máthéné Szigeti, assistant professor, PhD

Lecturer: Dr. Zsuzsa Máthéné Szigeti, assistant professor, PhD

Title of course:Animal physiology I **Code**: TTBBG3001_EN	**ECTS Credit points:** 2

Type of teaching, contact hours

- lecture:-
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: -
- practice:28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 2nd year, 2nd semester

Its prerequisite(s):

Further courses built on it: TTBBG3001_EN

Topics of course

To provide the students with the necessary amount of knowledge (both theoretical and practical) which allows them to fully understand the physiological activity of the animal and human body and the most important regulatory mechanisms governing its function.

Topics: Homeostasis. Extra- and intracellular fluids. Buffer systems of body. Oxygen transfer. Clotting. Physiology of blood, heart, circulatory, respiratory and alimentary systems. Hormonal and neural regulation of circulatory, respiratory and alimentary systems.

Literature

Compulsory:

Knut Schmidt-Nielsen: Animal physiology, Cambridge University Press, 1997.
Eckert: Animal physiology. Mechanisms and adaptations. W.H. Freeman and Company, 1998.
Christopher D. Moyes, Patricia M. Schulte: Principles of animal physiology.Pearson Education In c. 2008.

Schedule:

1st week Homeostasis. Extra- and intracellular fluids. Fluid compartments of body. Special extracellular fluids. Transports across cellular membrane

2nd week Blood circulation systems: open and closed circulation. Types of heart pumps. Fish, Amphibia, Reptile circulation systems. Arteriosus and venous pressure in standingand prone positions. Birds and Mammals circulatory systems.

3rd week Circulatory systems. Flow of fluid between capillaries and cells. Blood supply of organs. Different parts of blood vessels. Main arteries and veins of organs. Circulatory systems of fetus and newborn

4th week Functionof heart. Histological and physiological characteristics of cardiac muscle. Pulmonary and systemic circuit. Coronary artery. Adaptation to high altitudes. Conducting pathway of heart. Cardiac adaptation. Cronotrophic, dromotrophic, inotrophic and bathmotrophic effects on heart.Hormonal and neuronal regulation of heart.

5th week Oxygen transport. The structure and oxygen equilibrium curve of hemoglobin and myoglobin. Oxygen affinity depending of Hb to temperature, pH and 2,3-bisphosphoglycerate. CO affinity to Hb. Methemoglobin. Blood clotting. Extrinsic and intrinsic way. Coagulation factor. Fibrin network formation, effect of thrombin in blood clotting. Fibrinolysis.

6th week **Mid-term test.** Homeostasis, evolution of circulatory system, parts of heart and regulation of movement of heart. Blood cells, oxygen carrying of blood. Mechanism of coagulation.

7th week Mechanics of respiration. Upper and lower part of respiratory system. Lung volumes and capacities. Disorders of pulmonary gas exchange. Gas exchange across surface of alveoli, role of surface tension. Respiratory movements and their regulation. Respiration in air, water: gill, lung, trachea. Dissolving and diffusion of gases in water. Gas exchange and flow of water across gill. Diffuse and ventilation lung. Respiratory movements. Regulation of respiratory.

8th week Energy metabolism, nutrition, thermal regulation. Nutrient: carbohydrates, lipids, proteins. Liquid nutrients. Parasites, symbioticnutrition. Thermal equilibrium, centre and periphery temperature, fever.

9th week Digestion. Gut motoric and secretory locomotions. Comparison of different animal groups based on theirnutrition and digestion methods.

10th week The human stomach and digestive organs of gastrointestinal tract. Digestive enzymes. Function of pancreas. Regulation of enzyme production.

11th week Transport. Surfaces for transport of nutrients. Function of liver. Production of bile, its composition and function.

12th week The three main mechanisms of locomotion(amoeboid, ciliary, muscle). Smooth, cardiac and striated muscle. Molecular mechanism of muscle contraction.

13th week Discussion of the topics treated on lectures.

14th week **2. End-term test.**Types and regulation of respiration. Types and regulation of digestion. Types of muscles and locomotion; mechanisms of muscle contraction.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Students have to **submit all the two designing tasks** as scheduled minimum on a sufficient level.

During the semester there are two tests: the mid-term test in the 6th week and the end-term test in the 14th week. Students have to sit for the tests

- for a grade

The course ends in an **examination**. Based on the average of the grades of the designing tasks and the examination, the exam grade is calculated as an average of them:

- the average grade of the two designing tasks

- the result of the examination

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:
it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

Person responsible for course: Dr. Zsuzsa Máthéné Szigeti, assistant professor, PhD

Lecturer: Dr. Zsuzsa Máthéné Szigeti, assistant professor, PhD

Title of course:Plant Physiology I **Code**: TTBBE3010_EN, TTBBL3010_EN	**ECTS Credit points: 3+0+2**

Type of teaching, contact hours

- lecture: 2 hours/week
- practice:
- laboratory: 2 hours/week

Evaluation: exam, mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice:
- laboratory: 28 hours
- home assignment: 52 hours
- preparation for the exam: 42 hours

Total: 150 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): Plant anatomy

Further courses built on it: -

Topics of course

Plant metabolism and plant development. Plant water relations, water uptake, transport and processes of plant water budget. Utilization of light energy in photosynthesis. Carbon fixation pathways and photorespiration. Translocation in the phloem. Processes of carbohydrate breakdown. Assimilation of mineral nutrients with main focus on processes of nitrogen and sulphur assimilation. Photoreceptors and light control of plant developments. Growth regulation and role

of phytohormones. Responses of plants to environmental stresses. Basic experimental methods in studying metabolism and development of plants.

Literature

Compulsory:

- Jones R, Ougham H, Thomas H, Waaland S, eds. (2013) The molecular life of plants. Wiley-Blackwell

Recommended:

- Buchanan BB, Gruissem W, Jones RL, eds. (2000, 2015) Biochemistry and Molecular Biology of Plants. Blackwell-ASPB Books.
- Taiz L, Zeiger E (2010): Plant Physiology. (5th edition). Sinauer Assocoates, Inc., Publishers, Sunderland, Massachusetts.

Schedule:

1st week

Water balance of plants I. Structure and properties of water molecule. Definitions of chemical potential, and water potential. Water potential of plant cells, water potential and its components (solute potential, pressure potential, matrix potential). Physical laws of water movement: diffusion, osmosis, bulk flow. Water uptake by cells, water movements across cell membranes.

2nd week

Water balance of plants II. Water movements in soil-plant-atmosphere continuum. Structural properties of organs and tissues involved in water balance. Active and passive pathways of water absorption by roots. Phenomenon of „ root pressure". Water movements in roots, ways of short-term movements. Water transport in the xylem. Cohesion-tension theory of water transport in the xylem. Water loss from leaves. Guttation and transpiration. Regulation of transpiration, role of stomatal control. Movements of stomata.

3rd week

Mineral nutrition. Definition of nutrient. Essential and non-essential elements. Mineral defficiencies and plant metabolism disorders. Excess mineral elements and metabolism disorders. Techniques used in mineral nutrition studies. Soil properties influencing the availability of mineral nutrients. Role of mycorrhizal fungi in nutrient uptake by roots.

4th week

Photosynthesis in higher plants. Light reactions I.

Solar radiation and photosynthetically active radiation. Photosynthetic pigments: chemical characteristics and absorption spectra of main pigment groups. Organization of photosynthetic apparatus: chloroplast structure, main protein complexes involved in light reactions and their localization in the thylakoid membrane system. Organisation of photosystem I and II: light harvesting antennas and reaction centres.

5th week

Photosynthesis in higher plants. Light reactions II. Electron transport in the chloroplast. Water oxidation by PSII. Electron flow through the cytochrome b_6f complex and the related proton transport through the thylakoid membrane. Role of plastocyanin in the electron transport between PSII and PSI. NADPH formation by PSI. ATP synthesis in the chloroplast. Cyclic electron flow. Repair and photoprotection of photosynthetic apparatus.

6th week

Carbon reactions of photosynthesis I. The Calvin-Benson Cycle (C_3 CO_2 fixation pathway): carboxylation, reduction and regeneration stages. The key enzyme: ribulose 1,5 bisphosphate carboxylase and oxygenase. The C_2 oxidative photosynthetic carbon cycle. Role of photorespiration during stress. Regulation of C_3 cycle.

7th week

Carbon reactions of photosynthesis. Inorganic carbon-concentrating mechanisms. The C_4 carbon cycle and special leaf anatomy. Single cell C_4(SCC_4) carbon fixation. Crassulacean acid metabolism (CAM). Synthesis of starch and sucrose. Photosynthetic responses to environmental factors.

8th week

Translocation in the phloem. Composition of phloem sap. The pressure-flow model of phloem transport. Phloem loading in source tissues: symplastic and apoplastic pathways. Phloem unloading processes at sink tissues.

9th week

Nitrogen assimilation I. Biological nitrogen fixation: nodule formation, nitrogenase enzyme complex, transported nitrogen compounds. Nitrate assimilation, key enzymes and processes: nitrate reductase and nitrite reductase. Ammonium assimilation: enzymes involved in conversion of ammonium into amino acids. Sulphur assimilation: processes involved in sulphate assimilation. Connection between photosynthesis, nitrate assimilation and sulphate assimilation.

10th week

Respiration and lipid metabolism. Reserved carbohydrates in plants and their breakdown processes to monomers. Glycolysis: alternative glycolytic reactions in plants. The citric acid cycle and its unique properties in plant cells. Mitochondrial electron transport and ATP synthesis. The oxidative pentose phosphate pathway. Lipid metabolism. Function of lipids in plants. Stored lipids: conversion into carbohydrates during germination.

11th week

Light perception and transduction: role of photoreceptors. Phytochromes and photomorphogenesis. Physiological responses to blue light and ultraviolet radiation. Role of cryptochromes, phototropins, Zeit-lupe receptors.

12th week

Plant growth and development I. External and internal growth regulating factors. General considerations: phytohormones have similarities and dissimilarities from animal hormones. Auxins and citokinins.

13th week

Plant growth and development II. Gibberellins, abscisic acid, ethylene, brassinostreoids, strigolactones, jasmonate, salicylic acid.

14th week

Plants in changing environment. Carbon balance of plants and environmental stress. Responses of plants to environmental stresses: excess light, drought, flooding, salinity, heavy metals.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **practice classes** is compulsory.

Students are required to read the experimental protocols and understand the tasks during each practice class.

In case of laboratory class there are tests from experimental issues of every main course topic during the semester.

- for a grade in case of the lecture:

The course ends in an **examination.**

-for a grade in case of the practice class:
The result of tests and teacher's evaluation of participation in the experimental work are involved.

The minimum requirement for both the examination and laboratory grade is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:
it may be offered for students if the average grade of the designing tasks is at least satisfactory (3)

Person responsible for course: Dr. Máthé Csaba, associate professor, PhD

Lecturer: Dr. Máthé Csaba associate professor, PhD

Dr. Mészáros Ilona, associate professor, PhD

Dr. Surányi Gyula assistant professor, PhD

Title of course:Genetics **Code**: TTBBE3020_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it:?

Topics of course

The series of lectures are based on the topics of classical and molecular genetics. It reviews the discovery of DNA, RNA and protein as genetic material. We will discuss DNA replication and the repair mechanisms of DNA. Chromatin and chromosome structures will be reviewed during classes, but also chromosomal aberrations. We will discuss gene expression and its regulation on

DNA and chromatin level. In regard of gene expression also genetic code and mutations will be discussed. Basics of mitotic and meiotic cell division will be reviewed. Mendelian genetics will follow after: principles of Mendel, different types of inheritances. We will then continue the course with sex determination and sex-linked inheritances of different organisms. We will end the lecture course with the basics of meiotic and non-meiotic recombination events.

Literature

Compulsory:
- List of keywords sent out. Lecture materials sent out. Lecture notes taken during classes.

Recommended:
- Daniel L. Hartl: Essential Genetics, 6th edition; ISBN-13: 978-1449686888
- Jocelyn E Crebs et. al.: Lewin's Genes XII; ISBN-1: 978-1284104493

Schedule:

1st week: Introduction: genetics as a science field; historical overview. The nature of genetic material. DNA and RNA as genetic material. Prions.

2nd week: Structure of DNA. Superhelicity of DNA. The organization of prokaryotic genome.

3rd week: DNA organisation of eukaryotes: chromatin structures – euchromatin and heterochromatin. Basics of epigenetics.

4th week: Structure of chromosomes. Telomere and telomerase. Chromosome sets – euploidy and aneuploidy. Human chromosomal aberrations. Prenatal diagnostics.

5th week: DNA replication mechanisms. Polymerase chain reaction (PCR). DNA repair mechanisms.

6th week: The mitotic cell division and its significance. Nondisjunction and its significance.

7th week: The first step of gene expression: transcription in prokaryotes and eukaryotes.

8th week: Regulation of transcription. Posttranscriptional modifications.

9th week: The second step of gene expression: translation and the genetic code. The change of genetic code – mutations.

10th week: Meiotic cell division, neocombination. Life cycles. The generation of human gametes.

11th week: Laws of Mendel. Mendelian inheritance – dominant and recessive autosomal inheritances.

12th week: Nonmendelian inheritances. Multifactorial inheritance.

13th week: Sex determination and sex linked inheritances.

14th week: Meiotic recombination and its use in genetic mapping. Somatic recombination.

Requirements:

- for a signature
Attendance at **lectures** is recommended, but not compulsory.

- for a grade
The course ends in an **examination**. Exam is taken in exam period. It is primarily in written form, composed of A and B part. A part is composed of "true or false" questions and keywords, and 70 % must be reached. B part is composed of single choice, multiple choice tests, figures, fill in tests, long and short essays. Grade will be given based on the B part, but A part must be passed.

Score	Grade
0-49	fail (1)
50-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If required oral exams can be taken.

Person responsible for course: Dr. Gyula Batta, senior lecturer, PhD

Lecturer: Dr. Gyula Batta, senior lecturer, PhD

Title of course:Molecular biology **Code**: TTBBE3025_EN	**ECTS Credit points:** 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment:
- preparation for the exam:62 hours

Total: 90 hours

Year, semester: 2nd year, 4th semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Review of basic concepts, such as genome, gene, chromosome, DNA, RNA etc. Structure of DNA, DNA extraction and purification methods. Gel electrophoresis. Pulsed field gel electrophoresis. Restriction enzymes in molecular biology and their application. Vectors for recombinant technology: plasmid and viral vectors, cosmids, artificial chromosomes, cloning and expression vectors. PCR methods. Gene expression, central dogma, cDNA synthesis. Cloning of genes. Ligation.

Transformation. DNA sequencing methods. Genome sequencing of model organisms, human genome project and its results. DNA libraries. Southern-blot hybridisation. Studying of gene expression: quantitative PCR, microarray methods.

Literature

RJ Reece: Analysis of Genes and Genomes , Wiley and Sons LtdISBN:0-470-84379-9

Schedule:

1st week

Introduction. Review of basic concepts, such as genome, gene, chromosome, DNA, RNA etc.

2nd week

Structure of DNA, DNA extraction and purification methods.

3rd week

Gel electrophoresis. Pulsed field gel electrophoresis.

4th week

Restriction enzymes in molecular biology and their application.

5th week

Vectors for recombinant technology. Plasmid and viral vectors, cosmids, artificial chromosomes, cloning and expression vectors.

6th week

PCR methods.

7th week

Gene expression, central dogma, cDNA synthesis.

8th week

Cloning of genes. Ligation. Transformation.

9th week

DNA sequencing methods.

10th week

Genome sequencing of model organisms, human genome project and its results.

11th week

DNA libraries. Southern hybridisation.

12th week

Studying of gene expression:quantitative PCR, microarray methods.

13th week

Consultation.

14th week

Essay writing.

Requirements:
Attendance at **lectures** is recommended, but not compulsory. The course ends with **exam.**

The minimum requirement for the exam is 50%.

Score	**Grade**
under 50%	fail (1)
50-63%	pass (2)
64-76%	satisfactory (3)
77-89%	good (4)
90-100%	excellent (5)

If the score of the exam is below 50%, students can take further exams according to the EDUCATION AND EXAM RULES.

Person responsible for course: Dr.Ida Miklós, associate professor, PhD

Lecturer: Dr.Ida Miklós, associate professor, PhD

Title of course:General Microbiology and Mycology **Code**: TTBBE3030_EN	**ECTS Credit points:** 3

Type of teaching, contact hours
- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The history of microbiology. The domain of Bacteria. The domains Archaea and Eukarya. Microbial taxonomy. The phyla of Archaea. The phyla of Bacteria: Deinococcus-Thermus, Chroroflexi, Chlorobi, Cyanobacteria, Chlamydiae, Spirochetes, Bacteroidetes, Proteobacteria, Firmicutes and Actinobacteria. Basics of virology, virus types. Plant, animal viruses and bacteriophages. Prions and plasmids. Eukaryote diversity. Taxonomy of true fungi and fungal-like

organisms. Phyla of true fungi. Symbiosis: microbes as symbionts. Pathogenic microbes. Virulence factors. Antibacterial drugs. Medical protozoology. Basics of mycology. Fungal life cycles. The most important species of biotechnologically or medically important fungal species. Secondary metabolites of fungi. Plant parasitic fungi. Fungi as symbiontic organisms. Sporulation and spore dispersion. Medical mycology.

Literature

Compulsory:
Handout slides of the course.
Recommended:
Willey, J., Sherwood, L., Woolverton, C. J.: Prescott's Microbiology, 9th Edition, McGraw-Hill Education, 2014
Cavalier-Smith, T.: Megaphylogeny, cell body plans, adaptive zones: causes and timing of eukaryote basal radiations. J. Eukaryot. Microbiol. 56, 26-33, 2009
Adl, S.M. et al.: The revised classification of eukaryotes. J. Eukaryot. Microbiol. 59, 429-514, 2012

Schedule:
*1st week*Introduction. The history of microbiology. Main methods and termini of microbiology. The microbiome of the planet Earth and its roles in the history of life. General features of microbes.

*2nd week*The growth curve of microbes. Environmental conditions and their effects on microbes.The characteristic features of Bacteria. The size, morphology and subcellular anatomy of prokaryotes. The bacterial cell wall. Antibiotics.

3rd week Primary nutritional groups of organisms. Bacterial locomotion. Endospores. The charcteristic features of Archaea. Archaeal cell walls and membranes. Eukaryotic cell organelles. Eukaryotic locomotion. Mitosis and meiosis, eukaryotic life cycles and spores.

4th week Microbial taxonomy. The evolution of the three domains. Bacterial tree of life. Archaeal phyla. Methanogenic archaea.

*5th week*Symbiosis and parasitism in the domain Bacteria. Virulence of bacteria and immune activity against pathogens. Microbiome. Deinococci and Gram-negative prokaryotes. Introduction for the phyla Cloroflexi, Chlorobi, Cyanobacteria, Chlamydiae, Spirochaetes and Bacteroidetes

*6th week*Proteobacteria. Alpha-, Beta-, Gamma-, Delta- and Epsilonproteobacteria and their most important species.

7th week Gram-positive bacteria with low G+C content. The phylum Firmicutes. Tenericutes. Mollicutes, Clostridia, Bacilli. The importance of biofilms. The human microbiome. High G+C Gram-positive bacteria. Phylum Actinobacteria, Actinomycetales, Actinomycineae, Micrococcineae, Corynebacterineae, Micromonosporineae, Propionibacterineae, Streptomycineae, Streptosporangineae, Frankineae. Bifidobacteriales. Immunisation against microbes.

*8th week*Viruses: thier characteristic features, morphology. DNA and RNA virus taxonomic groups. Bacteriophages. Plant viruses, viroids. Animal and human viruses.

*9th week*Plasmids of bacteria and yeasts. Prions. The taxa of Eukaryota. Medically important "protozoa".

*10th week*General mycology. The subject of mycology, the life cycles and anatomy of fungi. Taxonomy of fungi. The hypha and the fungal organelles.

11th week Fungal like organisms, slime moulds, Chytrids, Cryptomycota, Blastocladiomycota and "Zygomycota". Glomerulomycota and endomycorrhizae. Important species and genera.

*12th week*The sac fungi. The Ascomycota classes. Ascus and ascoma types. Conidia and conidiomas, conidiogenesis. Taphrinomycotina, Saccharomycotina, Pezizomycotina (Pezizomycetes, Sordariomycetes, Leotiomycetes, Eurotiomycetes, Dothideomycetes and Orbiliomycetes classes). Yeast as a polyphyletic group. Dimorphic growth. Ascomyota from industrial and medical perspectives. The most important species of the phylum.

*13th week*The Basidiomycota. Basidiospore formation, basidiocarps. Pucciniomycotina, Ustilaginomycotina and Agaricomycotina (Tremellomycetes and Agaricomycetes). Human mycoses and their treatments.

14th week Fungi in ecosystems. The fungal spores and their dispersion. Symbiosis between bacteria/fungi and plants and animals. Lichens. Plant pathogenic microbes. Nutrition of fungi. Mycoparasitism.

15th week Consultation.

Requirements:

- for a signature
Attendance of **9 of 15lectures (60%)** is compulsory.

- for a grade
The course ends in an **examination**.

The minimum requirement for examination is 60%. The grade for the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

-an offered grade:
it may be offered for students if they take an optional written exam before the first week of the exam period.

Person responsible for course: Dr. Valter Péter Pfliegler, assistant professor, PhD

Lecturer: Dr. Valter Péter Pfliegler, assistant professor, PhD

Title of course:Biotechnology **Code**: TTBBE3035_EN	**ECTS Credit points: 3**

Type of teaching, contact hours

- lecture: 2 hours/week
- practice:
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice:-
- laboratory: -
- home assignment:-
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The series of lectures are based on the topics of biotechnology: food and beverage biotechnology, recombinant enzymes, gene technology, cells as synthetic factories, viruses, antibodies and vaccines, environmental biotechnology, green biotechnology, embryos, clones and transgenic animals, stem cells, analytical biotechnology and the human genome, biosafety, public perception of biotehnology.

Literature

Compulsory:
-Reinhard Renneberg: Biotechnology for Beginners, Elsevier, ISBN: 978-0-12-373581-2

Schedule:

1st week

Introduction. The history of biotechnology. Biotechnology: an interdisciplinary pursuit.

2nd week

Substrates for biotechnology. Natural raw materials. Availability of by-products. Chemical and petrochemical feedstock. Raw materials and the future of biotechnology.

3rd week

Bioprocess/fermentation technology. The bioreactor. Media design for fermentation processes. Solid-substrate fermentation. Scale-up. Microbial, mammalian and plant cell cultures. Dowsntream processing.

4th week

White biotechnology. Cells as synthetic factories. Production of primer and secondary metabolites, like β-lactames, streptomycin, cyclosporin A, statines andsteroides.

5th week

Enzymes. Enzymes for detergents. Immobilized enzymes. Biosensors. Protein engineering and *in vitro* evolution.

6th week:

Food and beverage biotechnology. Alcoholic and lactic fermentation. Sweeteners. Beer and wine production. Functional foods. Vegetable and legume fermentations. Enzymes, additives and food processing.

7th week:

Green biotechnology. SCP. Mycoprotein. SCP from algae and wastes.

8th week:

Environmental biotechnology. Sewage water treatment. Biogas. Composting. Bioremediation. Silent mining. Microbes and the geological environment. Biodegradable plastics. Clean technologies.

9th week:

Biological fuel generation. Bioethanol and biogas from biomass. Biodiesel and biohydrogen.

10th week:

Genetics and biotechnology. Protoplast and cell-fusion technologies. Genetic engineering. Green biotechnology. Plant breeding. Transgenic plants. Heterologous protein expression in bacteria, plants, yeasts and mammalian cells. Recombinant insulin and somatostatin production.

11th week:

Agricultural biotechnology. Plant biotechnology. GM plants. Biocontrol. Biological insecticides. „Gene farming". Animal biotechnology. Dolly. Xenotransplantation. *In vitro* fertilization. Embryos, clones and transgenic animals. Artificial insemination. Embryo transfer.

12th week:

Biotechnology and medicine. Viruses and vaccines. Live and attenuated vaccines. Recombinant vaccines.Policonal, monoclonal and recombinant antibodies. Phage display. Myocardial infarction and anticoagulants. Recombinant EPO, Factor VIII. Stem cells. Gene therapy. RNA interference.

13th week:

Analytical biotechnology. Biosensors. Diagnostic tests. Immunological pregnancy tests. AIDS tests. The Human Genome. Pharmacogenomics. DNA Chips. Proteomics.

14th week:

Protection of biotechnological inventions. Patent protection. Trade secrets. Safety in biotechnology. Concepts of hazard and risk. Problems of organism pathogenicity. Biowarfare and bioterrorism.

Public perception of biotechnology. Genetic modification and food uses. The applications of human genetic research.

Requirements:

- for a grade
The course ends in an **examination**.

The minimum requirement for the examination respectively is 60%. The grade for the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

Person responsible for course: Dr. Éva Leiter, senior lecturer, PhD

Lecturer: Dr. Éva Leiter, senior lecturer, PhD

Title of course:Basic Ecology seminar **Code**: TTBBG3045_EN	**ECTS Credit points:** 3
Type of teaching, contact hours - lecture: -	

- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 62 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The role of global ecological studies in nature conservation. The effects of urbanization on terrestrial and aquatic ecosystems. The global effect of urbanization on carabid assemblages. Introduction to restoration ecology, methods of conservational grassland management. Planning of restoration ecological management practices. The most common methods used in grassland restoration: spontaneous succession, seed sowing and hay transfer. The basics of seed bank ecology, seed bank studies. The relationship between vegetation and seed bank. Environmental analytical methods in ecology. The most common sampling methods used in animal ecology. The significance and applicability of spiders in comparative ecological studies. The conservational role, species composition and spatial structure of saline and loess grasslands. The role of micro-relief in the maintenance of small-scale habitat diversity. The use of remote sensing for studying vegetation pattern. The biodiversity protecting role of habitat islands in agricultural landscapes. Ecological processes and mechanisms in forest edges. The nature conservational problems of invasive species. Organic agriculture and biodiversity of agro-ecosystems.

Literature

Compulsory:-
Recommended:
- M. Begon, J. L. Harper, C. R. Townsend (1990): Ecology, Blackwall, Oxford. ISBN-13: 978-0632038015

Schedule:

*1st week*Processes and principles in urban ecology.

*2nd week*The effects of urbanization and anthropogenic influences on terrestrial and aquatic ecosystems.

*3rd week*Introduction to restoration ecology, the methods of conservational grassland management. Basic terms of restoration ecology. Restoration, rehabilitation, creation, recultivation. Stability, resistance, resiliency. The planning of management practices in restoration ecology. The most common methods used in grassland restoration: spontaneous succession, sowing and hay transfer.

*4th week*Classic and dynamic biogeography models: the unified neutral theory of biogeography and biodiversity (Hubbel's neutral theory).

*5th week*Models and role of modelling in ecology. Computer simulation experiments.

*6th week*The basics of seed bank ecology, seed bank studies. The relationship between vegetation and seed bank. Seed bank, vertical and horizontal seed bank profile. Density of seed bank. Viability of seeds. Types of seed banks. The significance of seed bank studies. A case study.

*7th week*Environmental analytical methods in ecology. The role of chemical analytics in environmental protection. The steps of analytical processes. Sampling methods. Types of sample preparation. Methods for the determination of the composition of solutions. Analytical projects in the Department.

*8th week*The significance and applicability of spiders in comparative ecological studies. The most common sampling methods in arachnology. Protected species. Hunting strategies.

*9th week*Effects of grazing and urbanization on spider assemblages.

*10th week*The conservational role, species composition and spatial structure of saline and loess grasslands. The role of micro-relief in the maintenance of small-scale habitat diversity. The use of remote sensing for studying vegetation pattern.

*11th week*The role of cultural sites in nature conservation. The biodiversity conservation role of habitat islands in agricultural landscapes. Kurgans as habitats, and their significance in maintaining grassland biodiversity.

*12th week*Ecological processes and mechanisms in forest edges.

*13th week*Invasive species. Biological invasion, the chances of the establishment of invasive species. The strategies of invasive species. The nature conservational problems of invasive species.

*14th week*Organic agriculture and biodiversity of agroecosystems. The role of cover crop in organic agriculture and in maintaining agrobiodiversity. A case study.

Requirements:

- for a signature

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade

- The course ends in a **term mark**.

The following grades are possible for the written and oral parts of the presentation:

Grade
fail (1)

pass (2)
satisfactory (3)
good (4)
excellent (5)

Person responsible for course: Dr. Roland Horváth, senior lecturer, PhD,
Dr. Orsolya Deák-Valkó, senior lecturer, PhD,
Dr. BalázsDeák, senior lecturer, PhD

Lecturer: Dr. RolandHorváth, senior lecturer, PhD
Dr. Orsolya Deák-Valkó, senior lecturer, PhD,
Dr. BalázsDeák, senior lecturer, PhD,
Prof. Dr. Péter Török, university professor, DSc,
Dr. Edina Kundrát-Simon, associate professor, PhD
Prof. Dr. BélaTóthmérész, university professor, DSc
Prof. Dr. TiborMagura, university professor, DSc

Title of course:Biodiversity seminar **Code**:TTBBG3050_EN	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: -
- practice:2hours/week
- laboratory:-

Evaluation:exam, mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice:28hours
- laboratory: -
- home assignment: 62 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 2nd year, 1st semester

Its prerequisite(s):-

Further courses built on it:-

Topics of course

The course provides a practical knowlede on the application possibilities of statistical methods regarding the measurements of biodiversity.

Literature

- Magurran, A.E. and McGill, B.J. 2011: Biological Diversity: Frontiers in Measurement and Assessment. Oxford University PressISBN: 0199580677
- Clark, J.S. and Gelfand, A. 2006: Hierarchical Modelling for the Environmental Sciences: Statistical Methods and Applications. Oxford University Press. ISBN: 9780198569671

Schedule:

1st weekIntroduction to the course

2nd weekStatistical measures for calculating biodiversity I.

3rd weekStatistical measures for calculating biodiversity II.

4th weekReview of classical statistical methods.

5th weekSpecies number and species richness, saturation of species richness.

6th weekDynamics of species richness

7th week: Mid-term test

8th weekDiversity measures I

9th weekDiversity measures II

10th weekSimpson and Shannon diversity

11th weekCalculation of RTS diversity

12th weekEnthropy

13th weekCalculation of diversity by the Rényi functions

14th weekEnd-term test

Requirements:

Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there are two tests: the mid-term test in the 7th week and the end-term test in the 14th week.

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

-an offered grade:

it may be offered for students if the average grade of the tests is at least satisfactory. The offered grade is the average of them.

- in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to have an exam in the exam session

Person responsible for course: Dr. Deák Balázs, assistant professor, PhD;

Lecturer: Dr. BalázsDeák, assistant professor, PhD;

Dr. Orsolya Deák-Valkó, assistant professor, PhD

Dr Edina Kundrát-Simon, associate professor, PhD

Title of course:**Ecological examination methods** **Code**: TTBBE3055_EN	**ECTS Credit points: 2**

Type of teaching, contact hours

- lecture:1hours/week
- practice: -
- laboratory:-

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 14 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 46 hours

Total: 60 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The course introduce the students the basics of research planning, experimental research and elementary statistics and data capture. It provides essential knowledge in the most important field methods of data collection. The course focus on methods frequently used in environmental assessment and evaluation focusing on essential sampling methods of vegetation coverage and height, biomass, soil seed bank, and the sampling of water plants, algae and animal communities. The course introduce the theory of trait-based ecosystem analyses, provide information of trait measurements and analyses, and provide essential guideline for trait-based ecosystem engineering and ecological strategies based analyses.

Literature

- Gordon A. Fox, Simonetta Negrete-Yankelevich, Vinicio J. Sosa (eds.) (2015): Ecological Statistics – Contemporary theory and application. Oxford University Press, Osxford.
- Moore PD and Chapman SB (1986): Methods in plant ecology. Blackwell Scientific Publications, Oxford.

- Martin Kent, Paddy Cooker (1995): Vegetation description and analysis – A practical approach. Wiley, Chichester.

Schedule:

*1st week*Introduction to the course

*2nd week*Field sampling and design of experiments

*3rd week*Elementary statistics and data analysis I

*4thweek*Elementary statistics and data analysis II

*5th week*Sampling of terrestrial plant communities I

*6th week*Sampling of terrestrial plant communities II.

7*th week*Sampling of terrestrial plant communities III.

8th week: Mid-term test

*9th week*Sampling in freshwater communities I

*10th week*Sampling in freshwater communities II

*11th week*Sampling in animal communities I

*12th week*Sampling in animal communities II

*13th week*Sampling in animal communities III

*14th week*End-term test

Requirements:

Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there are two tests: the mid-term test in the 7th week and the end-term test in the 14th week.

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)

80-89	good (4)
90-100	excellent (5)

-an offered grade:

it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

- in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to have an exam in the exam session

Person responsible for course: Prof. Dr. Péter Török, university professor, DSc.

Lecturer: Prof. Dr. Péter Török, university professor, PhD, DSc.
Dr. Balázs Deák, assistant professor, PhD
Dr. Orsolya Valkó, assistant professor, PhD
Dr. Roland Horváth, assistant professor, Ph.D.

Title of course:Ecological examination methods practice **Code**: TTBBG3055_EN	**ECTS Credit points:** 3

Type of teaching, contact hours
- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:
- lecture: -
- practice: 28 hours
- laboratory: -
- home assignment: 62 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The course provides practical knowledge on the basic ecological examination methods focusing on botany and zoology. The students get information on selection of the proper methodology, ways of sample preparation, and evaluation of field data.

Literature

Compulsory:-
Recommended:
- M. Begon, J. L. Harper, C. R. Townsend (1990): Ecology, Blackwall, Oxford. ISBN-13: 978-0632038015
- Harper, J. L. 1977: Population Biology of Plants, Academic Press, London, pp. 829

Schedule:

1st week Introduction to the course

2nd week Botanical surveys, coenological methods

3rd week Botanical surveys, species area relations

4th week Estimation of biomass production, field methods, sample sorting

5th week Sampling of the seed bank, sample preparation, germination in greenhouse

6th week Sampling connected to seed dispersal

7th week Mid-term test

8th week Sampling of Orthopterans and True Bugs

9th week Sampling of Lepidopterans

10th week Sampling of Amphibians

11th week Sampling of Reptilians

12th week Monitoring of bird species

13th week Sampling of small mammals

14th weekEnd-term test

Requirements:

Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there are two tests: the mid-term test in the 7th week and the end-term test in the 14th week.

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)

90-100 excellent (5) -an offered grade: it may be offered for students if the average grade of the tests is at least satisfactory. The offered grade is the average of them. - in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to have an exam in the exam session
Person responsible for course: Dr. Orsolya Deák-Valkó, senior lecturer, PhD Dr. Balázs Deák, senior lecturer, PhD
Lecturer: Dr. Roland Horváth, senior lecturer, PhD, Dr. Orsolya Deák-Valkó, senior lecturer, PhD Dr. Balázs Deák, senior lecturer, PhD

Title of course: Population genetics and evolutionary biology, Population genetics and evolutionary biology seminar **Code**: TTBBE3060_EN, TTBBG3060_EN	**ECTS Credit points:** 3+2
Type of teaching, contact hours - lecture: 2 hours/week - seminar: 2 hour/week - laboratory: -	
Evaluation: exam, mid-semester grade	
Workload (estimated), divided into contact hours: - lecture: 28 hours - practice: 28 hours - laboratory: - - home assignment: 32 hours - preparation for the exam: 62 hours Total: 150 hours	
Year, semester: 1st year, 2nd semester	
Its prerequisite(s):-	
Further courses built on it:-	

Topics of course

The history of evolutionary biology. Genetic introduction. Genetic variation in natural populations, molecular methods to estimate it. The Hardy-Weinberg equilibrium. The source of genetic variation: mutation. Types of preferentiality in mating. Inbreeding. Genetic drift, bottle neck and founder effect. Selection: types, fitness, allele frequency changes during different types of selection. Elementary quantitative genetics. Genetic differentiation and migration. Different species concepts. Speciation. Coevolution. The evolution of biosphere. Adaptive radiations and mass extinctions.
The topics of the seminar: Calculation of allele frequencies. Statistical test of the Hardy-Weinberg equilibrium. Calculation of allele frequencies in case of dominance. Calculation of allele frequencies at X linked loci. Calculation of the inbreeding coefficient. genotype frequencies in

inbred populations. calculation of fitness components and net fitness. Allele frequencies in overdominant selection.

Literature

Compulsory:
- Futuyma, D.J. 2005. *Evolution*. Sinauer Associates Inc., Sunderland, ISBN 0-87893-187-2.

Recommended:
- Hedrick, P.W. 1985. *Genetics of populations*. Jones and Bartlet Publishers, Boston ISBN 0-86720-011-1
- Ridley, M. 1996. *Evolution*. Blackwell Science, Cambridge ISBN 0-86542-495-0

Schedule:

1st week: Introduction to Evolutionary biology. A historical background.

2nd week: Genetic variation in natural populations. Molecular methods to analyse genetic variation.

3rd week: The Haerdy Weinberg principle.

4th week: The evolutionary significance of mutation.

5th week: Types of preferentiality in mating. Inbreeding.

6th week: Genetic drift. Bottle neck and founder effect.

7th week: Types of selection. Allele frequency changes under selection.

8th week: Elementary quantitative genetics.

9th week: Genetic differentiation.

10th week: Migration models.

11th week: Species concepts. Reproductive isolation. Basic types of speciation.

12th week: Coevolution.

13th week: The evolution of the biosphere.

14th week: Adaptive radiations and mass extinctions. Adaptive radiations and mass extinctions

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **seminars** is compulsory. A student must attend the seminars and may not miss more than once during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at seminars will be recorded by the leader.

- for a grade

The course ends by an **examination: one test for the seminars and one for the lectures**. The grades of both tests are calculated on the basis of the results of the tests.

Person responsible for course: Dr. Judit Bereczki, assistant professor, PhD
Lecturer: Dr. Judit Bereczki, assistant professor, PhD

Title of course: Biogeography **Code**:TTBBE3065_EN	**ECTS Credit points: 3**

Type of teaching, contact hours

- lecture: 2 hours/week
- seminar: -
- laboratory: –

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: –
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 1st year, 2nd semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Subject, history and methodology of biogeography. Tectonics. Phylogenetical biogeography. Analitical and regional biogeography: regional biogeography of large biocycles. Distribution and colonisation. Characteristics of distribution area. Filogeography and its practical importance. Climatic characteristics, vegetation- and fauna history, and evolutionary dynamics. of the Quarter. Regionality and evolutionary history of bioms. Phytogeography: flora and vegetation. Zonality, succession and klimax. Floristic elements. Relicts and endemisms. Vegetation zones of planet Earth.- Rainforests, subtropical areas. Grasslands of the temperate zones. Forest-steppes. Broadlief and needleleaf forests. Arctic and mountain territories. Vegetation of Hungary and Pannonian Basin and its floristic division. Zoogeography. Animals of Pannonian Basin.

Literature

Compulsory:

–

Recommended:

Udvardy, M. D. (1969). Dynamic zoogeography. – Van Nostrand Reinhold Company
Brown, D. (2009). Biogeography. – Sinauer Associates.

Schedule:

1st week: Basic principles of biogeography, historical aspects.
2nd week: Climatic trends.
3rd week: Continental drift.
4th week: Distribution: types, effectiveness,

5th week: Colonization.
6th week: Island biogeography.
7th week: Analitical and regional biogeography.
8th week: Climatic characteristics, vegetation- and fauna history, and evolutionary dynamics. of the Quarter.
9th week: Regionality and evolutionary history of bioms.
10th week: Phytogeography: flora and vegetation. Zonality, succession and klimax. Floristic elements..
11th week: Phytogeography: Relicts and endemisms. Vegetation zones of planet Earth..
12th week: Zoogeography.
13th week: Modern methods in biogeography.
14th week:Molecular phylogeography and its practical importance.

Requirements:

- for a signature
Attendance at **lectures** is recommended, but not compulsory.

During the semester there is a test: the end-term test in the 15th week. Students have to sit for the tests

- for a grade
The course ends in an **examination**. Based on the average of the grades of the designing tasks and the examination, the exam grade is calculated as an average of them:

- the average grade of the two designing tasks
- the result of the examination

The minimum requirement for the mid-term and end-term tests and the examination respectively is 50%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-49	fail (1)
50-59	pass (2)
60-69	satisfactory (3)
70-79	good (4)
80-100	excellent (5)

If the score of the is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:
it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

Person responsible for course: Prof. Dr. Attila Molnár, university professor, DSc

Lecturer: Prof. Dr. Attila Molnár V., university professor, DSc,
Dr. Gábor Sramko, senior research fellow, PhD
Dr. András Tartally, senior lecturer, PhD

Title of course:Environmental and nature protection **Code**: TTBBE3070_EN	**ECTS Credit points: 3**

Type of teaching, contact hours
- lecture: 2 hours/week

- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:
- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The emergence of an environmental crisis. The main environmental problems: overpopulation, global warming, soil degradation, deforestation. Problems with energy production, conditions of water supply, waste and its environmental hazard. Natural values of the Earth, conservation of biodiversity. Protection of habitats, prevention of species extinction. Activities of nature conservation.

Literature

Compulsory:

H. Frances (2005): Global Environmental Issues. John Wiley & Sons, USA
ISBN: 978-0-470-09395-5
M. K. Wali, F. Evrendilek, M. S. Fennessy (2009): The Environment: Science, Issues, and Solutions. CRC Press ISBN: 9780849373879
J.M. Fryxell, A. R. E. Sinclair, G. Caughley (2014): Wildlife Ecology, Conservation, and Management. Wiley-Blackwell ISBN: 978-1-118-29106-1

Schedule:

1st week

The main environmental problems. The development of environmental protection.

2nd week

Nature protection. The regulation and system of nature conservation. Types of nature protected areas.

3rd week

The methods of conservation. Legal instruments to protect nature. International conventions for nature conservation.

4th week

The largest national parks of the world.

5th week

The demographic processes of the world. Population indicators. Characteristics of the population of developed and developing countries.

6th week

The development of energy supply. The benefits and disadvantages of fossil and renewable energy sources and their use.

7th week

Environmental risks of nuclear energy and its use.

8th week

Water resources on Earth. Problems with drinking water supply. Types of wastewater, basics of wastewater treatment.

9th week

Concept and types of waste. Waste management (recovery, disposal).

10th week

Harmful environmental impacts on soil: soil contamination, soil degradation, secondary salinisation.

11th week

Air pollutants and their effects: smog formation, climate change, reduction of stratospheric ozone, acidification of the environment.

12th week

Forest-related problems: forest degradation, deforestation. The environmental role of forests.

13th week

The impacts of environmental change on the individual and on society.

14th week

Consultation or exam.

Requirements:

- for a signature
Attendance at lecturesis recommended, but not compulsory.

- for a grade
The course ends in an written examination. 2 (Pass) grade: 50% of the maximum points available. If the score of any test is below 50%, students can take a retake test.

-an offered grade:
There are at least two tests during the semester, and the offered grade is the average of them.

Person responsible for course: Kaszáné Dr. Kiss Magdolna, assistant professor, PhD

Lecturer: Kaszáné Dr. Kiss Magdolna, assistant professor, PhD
Dr. Simon Edina, associate professor, PhD
Dr. Gyulai István, assistant professor, PhD

Title of course:Environmental and nature protection **Code**: TTBBG3070_EN	**ECTS Credit points: 2**

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: -

- practice: 28 hours
- laboratory: -
- home assignment: 32 hours
- preparation for the exam: -

Total: 60 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

Knowing the environmental problems in detail. Investigating changes in the environment.The methods and significance of environmental monitoring. Monitoring of biodiversity. Bioindication.

Literature

Compulsory:

M.J. Groom, G.K. Meffe, C.R. Carrol (2006): Principles of Conservation Biology. Sinauer Associates, Inc.
ISBN: 0-87893-518-5
H. Frances (2005): Global Environmental Issues. John Wiley & Sons, USA
ISBN: 978-0-470-09395-5
M. K. Wali, F. Evrendilek, M. S. Fennessy (2009): The Environment: Science, Issues, and Solutions. CRC Press ISBN: 9780849373879

Schedule:

1st week

Global situation of biodiversity.

2nd week

Analysis of the consequences of climate change.

3rd week

Acid rain and its effects on the environment.

4th week

Water supplies and the extreme flow regimes.

5th week

The problem of decreasing the wetland extension.

6th week

The impact of urbanization on the wildlife

7th week

Consultation about the previous topics.

8th week

The concept, purpose, object and means of environmental monitoring. Elements of the monitor systems.

9th week

Features of monitor databases, data processing, and analysis of trends.

10th week

Definition and types of sampling.

11th week

Anthropogenic impacts: pollution of soil, water and air, the need for risk assessment and remediation.

12th week

The concept and general criteria for biomonitoring. The task of biomonitoring and its perspectives in environmental and nature conservation.

13th week

The concept of bioindication, living organisms that indicate and measure environmental pollution.

14th week

Consultation.

Requirements:

- for a signature

Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. In case of further absences, a medical certificate needs to be presented.

- for a grade

The practice ends with submitting a term paper.

Person responsible for course: Kaszáné Dr. Kiss Magdolna, assistant professor, PhD

Lecturer: Kaszáné Dr. Kiss Magdolna, assistant professor, PhD

Dr. Edina Simon assistant professor, PhD

Dr István Gyulai, assistant professor, PhD

Title of course:**Animal Behaviour** **Code**: TTBBE3075_EN	**ECTS Credit points: 4**

Type of teaching, contact hours

- lecture: 3 hours/week
- seminar: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 42 hours
- seminar: -
- laboratory: -
- home assignment: -
- preparation for the exam: 78 hours

Total: 120 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The aim of the course is threefold. First, to shed light on the huge diversity of animal behaviour. Second, to introduce the within-individual (e.g. genetic, physiological, psychological) mechanisms responsible to generate this diversity. Third, to highlight those evolutionary processes shaping this diversity.

Literature

Compulsory:

Recommended:

- Dawkins, R. 1976, The selfish gene. OUP.
- Alcock, J. 2009. Animal behaviour: An evolutionary approach. Sinauer Press.
- Danchin, E., Giraldeau, L.-A., Cezily, F., 2008. Behavioural Ecology. OUP

Schedule:

1st week

Definition of animal behaviour. Tinbergen's four questions. The history of animal behaviour research.

2nd week

The units of behaviour. Control of behaviour. Stimuli, decision making and motivation.

3rd week

Ontogeny of behaviour. Nature or nurture?

4th week

Genetic effects, the genetic dissection of behaviour.

5th week

Environmental effects: maturation, hormones, early experiences, developmental homoeostases, play and inprinting.

6th week

Learning: types of learning, animal intelligence and its evolution.

7th week

Natural selection and adaptation. Units of selection: gene, individual, group and kin selection.

8th week

Basic models in behavioural ecology I: optimal foraging.

9th week

Basic models in behavioural ecology II: evolutionary game theory.

10th week

Animal communication: definition, evolution, ritualisation, design of signals, honest signals. Bees' dance language.

11th week

Sexual reproduction: costs and benefits. Evolution of anisogamy and primary sex ratio.

12th week

Sexual selection: intra- and intersexual selection, alternative mating tactics, mate choice.

13th week

Mating systems: monogamy, polygyny, polyandry. Parental care.

14th week

Social behaviour: costs and benefits. Animal societies, eusociality.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **seminar classes** is compulsory. A student must attend the seminars and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can't make up any seminar with another group. Attendance at seminar classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed seminar classes should be made up for at a later date, to be discussed with the tutor. Active participation is evaluated by the teacher in every class. If a student's behaviour or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class. On the seminar the students collects videos from the web and analyse them. They summarise their results in a short talk presented in the front of the class.

During the semester there is one test at the end of term. Students have to sit for the test

- for a grade

The course ends in an **examination**. The exam grade is given as the result of the examination. The exam consists of the definitions of five concepts of ethology and two short essays of topics in animal behaviour. To pass the exam the student must correctly define at least three concepts and reach a minimal grade of 2 for both essays.

If the students fail on the exam, they can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Prof. Dr. Zoltán Barta, university professor, DSc

Lecturer: Prof. Dr. Zoltán Barta, university professor, DSc

Title of course:Soil science **Code**: TTBBE4001_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: mid-semester grade

Workload (estimated), divided into contact hours:

- lecture: -
- practice:28 hours
- laboratory: -
- home assignment: 62 hours
- preparation for the exam: -

Total: 90 hours

Year, semester: 3rdyear, 1stsemester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The series of lectures gives an overview of soil formation and the physical, chemical and biological properties of soils. The students learn the basic characteristics of different soil types, and how soil formation connects with the vegetation and climatic factors. The students also learn the effects of anthropogenic activities recently threatening soils worldwide. The course provides basic knowledge for botany, nature conservation, environmental protection and agricultural studies. During the seminars the students elaborate on, present and discuss a topic of their choice pertaining basic or applied aspects of soil science.

Literature

Compulsory:-

Recommended:

- Blaskó L. 2008: Soil Science. University of Debrecen, *Centre*for*Agricultural* and Applied Economic Sciences. www.tankonyvtar.hu
- Kátai J. 2013: Applied Soil Science. University of Debrecen. www.tankonyvtar.hu

Schedule:

1st week

The study area of soil science. Basic abiotic and biotic components of soils. Solid, liquid and gaseous phases. The structure of soil: soil profile and soil layers.

2nd week

The substrates for soil formation: parental rocks and types of minerals. Primary and secondary minerals in soils. Structure, water and ion absorption of clay minerals and their role in soil formation and functioning.

3rd week

Abiotic and biotic processes in soil formation: Physical and chemical weathering, biological processes. The transport of products: leaching, eluviation, illuviation, chelation. Podzolization, laterization, calcification, salinization, gleying.

4th week

The organic components of soils: The edaphon and the significance of its different groups in soil processes. Decomposition of organic materials, humification, groups and properties of humic components. The distribution of humic compounds in the soil profile and their role in the nutrient cycles, water relations and thermal properties of soils.

5th week

The role of soil colloids: Inorganic and organic colloids in soils. Surface reactions: electric double layer, permanent and pH-dependent charges, ion- and water adsorption, ion exchange, protolytic reactions. The effects of soluble salts on soil properties. Soil pH, acidic and alkaline soils. The effect of soil pH on other soil processes and on the edaphon. Buffering capacity and components of soils.

6th week

Redox reactions in soils: redox reactions, reducing and oxidizing agents in soils. The dependence of redox potential on aeration. The effects of redox potential on biotic reactions in soils.

7th week

Nutrient cycles in soils: The role of the soil in the biogeochemical cycles. The mobilization and immobilization of nutrients. N-, P-, S-cycles in soils. The dynamics and effects of basic cations (K, Na, Mg, Ca) in soils. The dynamics of micronutrients.

8th week

Physical properties of soils: soil particles, soil aggregates and the pore space. Water relations, aeration, heat balance.

9th week

Soil geography: the effects of the climate and vegetation on soil formation and soil properties. Edaphic zones on Earth.

10th week

Genetic and diagnostic soil classification. The World Reference Base for Soil Resources.

11th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

12th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

13th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

14th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **seminars**is compulsory. A student may not miss more than one of the four seminars. In case a student does so, the subject will not be signed and the student must repeat the course. In case of more than one missed seminars a medical certificate needs to be presented. Being late is equivalent with an absence. Active participation is evaluated by the teacher in every seminar class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Each student has to prepare a brief review (~5 pages) on a selected topic and give a short presentation (~15 min) during the seminar classes based on his/her review. The chosen topics will be discussed at the seminars and the reviews will be evaluated by the lecturer. In order to get the signature the reviews must reach at least sufficient level.

- for a grade

The course ends with a**writtenexam**.

The minimum requirement due to pass the written exam is 50%. The grade for the exam is given according to the following table:

Score	Grade
0-50	fail (1)
51-62	pass (2)
63-75	satisfactory (3)
76-87	good (4)
88-100	excellent (5)

The final grade is calculated as an average of the seminar grade and the exam grade, respectively.

If the score of the exam is below 50%, students can retake the test in line with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Viktor Oláh assistant professor, PhD

Lecturer: Dr. Viktor Oláh assistant professor, PhD

Title of course:**Toxicology and ecotoxicology** **Code**: TTBBG4015_EN	**ECTS Credit points: 3**

Type of teaching, contact hours

- lecture:2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice: -
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 3rd year, 1st semester

Its prerequisite(s): -

Further courses built on it: -

Topics of course

The aim of the course to introduce the toxicology, the effect of toxic metals and analysis methods in toxicology. The course give knowledge about metal toxicants in air, water and soil; metabolism, absorption, distribution and elimination of toxicants;environmental risk assessment and analytical methods in toxicology.

Literature

- Hodgson E (2004) A textbook of modern toxicology. John Wiley and Sons.
Online ISBN: 9780471646778
- Nikinmaa M (2014) An introduction to Aquatic Toxicology. Elsevier. eBook ISBN: 9780124115811

Schedule:

*1st week*Introduction to the course

*2nd week*History of toxicology

*3rd week*Classification of metals, essential, non-essential, toxic and non-toxic metals

*4th week*Source and effect of cadmium

*5th week*Source and effect of lead

*6th week*Source and effect of copper

7th week: Source and effect of zinc

*8th week*Source and effect of mercury

*9th week*Source and effect of nickel

*10th week*Mid-term test

*11th week*Toxicology tests for metals with animal

*12th week*Toxicology tests for metals with plants

*13th week*Methods for analysis of metals

*14th week*End-term test

Requirements:

Participation at classes is compulsory. A student must attend the courses and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course.

During the semester there are two tests: the mid-term test in the 7th week and the end-term test in the 14th week.

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

-an offered grade:

it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.

- in case an offered grade cannot be given, or it is not convenient for the student there is a possibility to have an exam in the exam session

Person responsible for course: Dr. Edina-Kundrát-Simon, associate professor, PhD

Lecturer: Dr. Edina-Kundrát-Simon, associate professor, PhD

Title of course:Animal Ecology **Code**: TTBBG4030_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: 2 hours/week
- practice: -
- laboratory: -

Evaluation: exam

Workload (estimated), divided into contact hours:

- lecture: 28 hours
- practice:
- laboratory: -
- home assignment: -
- preparation for the exam: 62 hours

Total: 90 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The aim of the course is to introduce the ecology, the animal ecology field and laboratory methods. The course gives knowledge and analysis about the effect of temperature, lights, radiation and salt content on animal population, and gives knowledge about predation, parasitism, symbiosis and mutualism, decomposers and detritivores, intra and interspecific competition.

Literature

Begon M, Harper JL, Townsend CR. Ecology. From Individuals to Ecosystems. Blackwell Scientific Publications, Oxford, 1986.
Molles MC. Ecology: Concepts and Applications. 7th Edition. McGraw-Hill Education. 2016

Schedule:

1st week: Introduction of the course.

*2nd week*Effect of temperature

*3rd week*Effect of light, and radiation

*4th week*Effect of salt content and chemical composition of environment

*5th week*Predation

*6th week*Parasitism

*7th week*Symbiosis and mutualism

*8th week*Decomposers and detritivores

*9th week*Intraspecific competition

*10th week*Interspecific competition

*11th week*Method of the soil and water collection

*12th week*Method of analysis of soil and water important physical and chemical parameters

*13th week*Visual, acoustic, trapping and other collection method

*14th week*End-term test

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can't make up any practice with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to **submit all the two designing tasks** as scheduled minimum on a sufficient level.

During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 15th week. Students have to sit for the tests

- for a grade

The course ends in an **examination**. Based on the average of the grades of the designing tasks and the examination, the exam grade is calculated as an average of them:

- the average grade of the two designing tasks
- the result of the examination

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

-an offered grade:

it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.
Person responsible for course: Dr. Edina-Kundrát-Simon, associate professor, PhD, habil
Lecturer: Dr. Edina-Kundrát-Simon, associate professor, PhD, habil

Title of course: Biochemistry II **Code**: TTBBE2040_EN	**ECTS Credit points:** 2
Type of teaching, contact hours - lecture: 2 hours/week - practice: - - laboratory: -	
Evaluation: exam	
Workload (estimated), divided into contact hours: - lecture: 14 hours - practice: - - laboratory: - - home assignment: - preparation for the exam: 46 hours Total: 60 hours	
Year, semester: 2nd year, 2nd semester	
Its prerequisite(s): Biochemistry I	
Further courses built on it: -	

Topics of course
The lectures describe the main features of protein structure, deal with the thermodynamic and kinetic background of enzyme catalyzed reactions, give an insight into the different strategies of controlling the enzyme activities. Nucleotide metabolism is also covered in details: *de novo* biosynthetic and salvage pathways, the formation of deoxyribonucleotides as well as the routes of the nucleotide degradation.
Literature

*Compulsory:*The lecture notes
Recommended:
Berg J.M., Tymoczky J.L., Gatto G.J. and Styer L.: Biochemistry (W. H. Freeman; Eighth edition, 2015), ISBN-13: 978-1464126109
Nelson D.L., Cox M.M.: Lehninger Principles of Biochemistry (W. H. Freeman Sixth edition, 2012) ISBN-13: 978-14234146
Voet D. and Voet J.: Biochemistry (Wiley, Fourth edition, 2010) ISBN-13: 978-0470570951

Schedule:

1st week

Structural feature of amino acids. Characteristics of peptide bonds, rotation angles of C(α), Ramachandran plot; Protein secondary structures; Forces and interactions in polypeptide chains; Supersecondary structuresand protein domains.

2nd week

Structural classification of proteins. Fibrous proteins:α-keratin, fibroin and the structure of collagen fibrils. Anfinsen's experiment and Levinthal's paradox. Protein folding and chaperons. Protein misfolding.

3rd week

Thermodynamics of enzyme catalyzed reactions. Models explaining substrate specificities. Characteristics of enzyme catalyzed reactions. Enzyme classifications.Factors influencing enzyme activity: temperature and pH.

4th week

Kinetic model of enzyme catalyzed reaction by Michaelis and Menten. The rate equation and the interpretation of the kinetic parameters. The efficiency of the enzymatic catalyses.Linearization of the Michaelis–Menten equation.

5th week

Reversible inhibition of enzyme activity in a competitive, uncompetitive and noncompetitive manner.Inactivation of enzyme activity - mechanism of penicillin action.

6th week

The Modifying protein function. Allosteric regulation. The models of cooperativity, characteristics of allosteric regulation.

7th week

Reversible covalent modification. The phosphorylation. The regulation of muscle and liver glycogen phosphorylases. Modifying protein function by small regulatory protein (calmodulin).

8th week

Limited proteolysis - zymogen activation. Pancreatic zymogens, the proteolytic cascade. The structural features of chymotripsin active site and the catalytic steps of serine proteases. Protein protease inhibitors.

9th week

Nucleotide Metabolism.The building blocks, the structures and the nomenclature of nucleotides. The biological function of nucleotides. The source of the nucleotide pool.

10th week

Pyrimidin *de novo* biosynthesis
The origin of the atoms of the pyrimidine rings. The formation of carbamoyl phosphate, the features of carbamoyl phosphate synthethase II (domain function and metabolic channel) and its regulation in eukaryotes.

11th week

The function and localisation of CAD and UMP synthase, the multienzyme comlex in mammals. The regulatory points of prokaryotic and eukaryotic pyrimidin *de novo* biosynthesis. The interconversion of nucleoside mono- di- and triphosphates. The synthesis of CTP.

12th week

Purin *de novo* biosynthesis.Origin of the ring atoms in purin. The regulation of the committed step of purin *de novo* biosynthesis. The features and the role of tetrahydrofolate in nucleotide biosynthesis. The branch point of purin *de novo* synthesis and the allosteric control to balance of AMP and GMP synthesis.

13th week

Salvage pathway of purin and pyrimidine biosynthesis. Deoxyribonucleotides biosynthesis: the structure, the mechanism and the regulation of ribonucleotide reductase.

14th week

Biosynthesis of thymidylate, the role of dihydrofolate reductase. Degradation of purin nucleotides, urate and gout. Degradation of pyrimidine nucleotides.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

- for a grade

The course ends in an **examination**.

The grade for the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of examination is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Dr. Terez Barna, assistant professor, PhD

Lecturer: Dr. Terez Barna, assistant professor, PhD

Title of course: **Sustainability and current environmental issues** **Code**: TTBBE4045_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: 1 hours/week
- practice: 1 hours/week
- laboratory: -

Evaluation: exam + seminar work

Workload (estimated), divided into contact hours:

- lecture: 14 hours
- practice: 14 hours
- laboratory: -
- home assignment: 10 hours
- preparation for the exam: 30 hours

Total: 68 hours

Year, semester: 1st year, 2nd semester (suggested)

Its prerequisite(s):

Further courses built on it: -

Topics of course

The course gives an overview of the background, rise and interactions of the current global environmental, demographic and social problems, and possible ways of their alleviation. The students learn the evolution of mankind's attitude towards its surroundings, the current issues of the globalized society and economy, and the components of the worldwide escalating humanitarian and ecological crisis. The students learn the concept of sustainable development and the pitfalls and constraints of transforming the current societal and economic paradigm. The course also reviews the currently applied indices of the social and economic progress, the alternative proxies to measure environmental sustainability and human welfare, and the recently elaborated environmental economics approaches to meet sustainability.
During the seminars the students present and discuss a selected topic of their choice, concerning their home regions'/countries' relevant environmental issues or good practices/projects in the field of sustainability.

Literature

Compulsory: -

Recommended:-

Course objective/intended learning outcomes

a) Knowledge

- He/she knows the background, development and interactions of the current issues of the globalized society and economy.
- He/she knows the fundamental social, economic and environmental principles and concepts to understand the current environmental and social problems and to interpret the basic concept of sustainability.

b) Abilities

- He/she is able to apply the most important terminology and theories of environmental and social sciences in connection with completing relevant tasks.
- He/she is able to interpret, put into context and apply new information pertaining the environment, economy and society when completing relevant tasks.

c) Attitude

- He/she is eager to learn about the processes of the natural environment and the effects of anthropogenic activities.
- He/she is open to gather new and environmentally relevant information and to use it in his/her profession.
- He/she performs environmentally conscious attitude both in his/her professional and private actions.

d) Autonomy and responsibility

- He/she makes decisions in complex and unexpected cases based on his/her professional knowledge.
- He/she is capable of considering complex, fundamental questions from his/her professional field and elaborating them on the basis of the given sources.
- He/she is able to cooperate with professionals from the fields of biology, agriculture, environmental science and social sciences.

Schedule:

1st week

The history and development of mankind's attitude towards the natural environment and its resources. The globalized economy and society and the rise of the global social and ecological crisis.

2nd week

Major components of the worldwide social and ecological crisis 1: Limited natural resources (natural ecosystems and genetic diversity, arable lands, freshwater, food production, non-renewable resources, e.g. fossil fuels and minerals)

3rd week

Major components of the worldwide social and ecological crisis 2: Limited natural sinks (air pollution: ozone depleting chemicals, greenhouse gases and climate change, smog; water pollution: eutrophication, petrochemicals, detergents, heavy metals, forever chemicals, plastics and microplastics; soil pollution, electronic waste, noise and light pollution)

4th week

Major components of the worldwide social and ecological crisis 3: Social aspects (overpopulation, urbanization, demographic trends, poverty, inequality, malnourishment and obesity, sanitary, contagions and further health issues)

5th week

The history of environmentalism (the raising awareness, international conferences and agreements, the impact of civil movements and NGOs)

6th week

The limits of growth and the interpretation of critical transitions and alternative stable states. Technological, economic and social constraints of the paradigm shift and the tragedy of the commons. The concept of sustainable development.

7th week

Demographic and economic indices. How to measure sustainability and human welfare? Social and economic proxies and indices to assess the environmental impact and sustainability.

8th week

Environmental economics: Society-level approaches, e.g. sharing economy, non-growth economy, circular economy. Policy-level approaches, e.g. command and control instruments, pollution quotas and tradeable emission, ecosystem services. Company-level approaches, e.g. PESTEL-analysis, clean production strategies, product life cycle assessment, green marketing

9th week

consultation

10th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

11th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

12th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

13th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

14th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **seminars** is compulsory. A student may not miss more than two of the five seminars. In case a student does so, the subject will not be signed and the student must repeat the course. In case of more than two missed seminars an official certificate needs to be presented. Being late is equivalent with absence. Active participation is evaluated by the teacher in every seminar class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

The students -alone or in small groups with up to 5 people- have to prepare a brief seminar project essay (~5 pages) on a selected topic concerning their home region's/country's relevant environmental issues or good practices/projects in the field of sustainability; and also to give a short presentation (~10 min) during the seminar classes based on their seminar projects. The chosen topics will be discussed at the seminars and the reviews will be evaluated by the lecturer. In order to get the signature the seminar projects must reach at least sufficient level.

- for a grade
The course ends with a **written exam**.

The minimum requirement due to pass the written exam is 50%. The grade for the exam is given according to the following table:

Score	Grade
0-50	fail (1)
51-62	pass (2)
63-75	satisfactory (3)
76-87	good (4)
88-100	excellent (5)

The final grade is calculated as an average of the seminar grade and the exam grade, respectively.

If the score of the exam is below 50%, students can retake the test in line with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Viktor Oláh associate professor, PhD

Lecturer: Viktor Oláh associate professor, PhD

Title of course: Ecophysiology **Code**: TTBBG4005_EN	**ECTS Credit points:** 3

Type of teaching, contact hours

- lecture: -
- practice: 2 hours/week
- laboratory: -

Evaluation: exam + seminar work

Workload (estimated), divided into contact hours:

- lecture: 20
- practice: 8 hours
- laboratory: -
- home assignment: 20 hours

- preparation for the exam: 30 hours

Total: 78 hours

Year, semester: 3rd year, 2nd semester

Its prerequisite(s):

Further courses built on it: -

Topics of course

The series of lectures gives an overview of plant environmental responses and the relationship between the environmental factors and physiological processes constraining the distribution of plants. The students learn the physiological effects of environmental extremes and anthropogenic activities and also the physiological, anatomical and morphological adaption mechanisms of plants to these factors. They also learn the potential application of this knowledge in the fields of nature conservation, environmental protection and agriculture. During the seminars the students elaborate on, present and discuss a topic of their choice in the field of plant ecophysiology. The subject provides basic knowledge for studies in the fields of ecology and environmental protection.

Literature

Compulsory: -

Recommended:

- Lambers, H., Chapin III, F.S-, Pons, L.T. 1998: Plant Physiological Ecology. Springer. New York-Berlin-Heidelberg.
- Schultze, E., D., Beck, E., Müller-Hohenstein, K. 2005: Plant Ecology. Springer-Verlag. New York-Berlin-Heidelberg.

Course objective/intended learning outcomes

a) Knowledge

- He/she knows the fundamental principles and concepts of plant ecology and ecophysiology.
- He/she knows the effects of environmental factors on plant physiological processes and productivity.
- He/she knows the basic ecological strategies of plants and the fundamental physiological, anatomical and morphological adaption mechanisms to the environmental factors.

b) Abilities

- He/she is able to apply the most important terminology and theories of plant ecology and ecophysiology when completing relevant tasks.
- He/she is able to interpret, put into context and apply new information regarding plant ecology and ecophysiology when completing relevant tasks.

c) Attitude

- He/she is eager to learn about processes of the natural environment and the effects of anthropogenic activities.
- He/she is open to gather new and environmentally relevant information and to use it in his/her profession.
- He/she performs environmentally conscious attitude both in his/her professional and private actions.

d) Autonomy and responsibility

- He/she makes decisions in complex and unexpected cases based on his/her professional knowledge.
- He/she is capable of considering complex, fundamental questions from his/her professional field and elaborating them on the basis of the given sources.
- He/she is able to cooperate with professionals from the fields of ecology, botany and agriculture.

Schedule:

1st week

The adaption of plants to their environment: the field of interest and core questions of plant ecophysiology. Relationships between the environmental resources, physiological tolerance and distribution of plants. Time-scales, reversibility and mechanisms of plant adaption.

2nd week

The plants and their environment: disturbance, subpessimum and stress. Synergism, additivity and antagonism of various stressors. The characteristics of different ecological strategies: the r- and K-, and the C-S-R strategists, respectively.

3rd week

The carbon balance and the productivity of plants: carbon balance and carbon allocation, growth analyses. Productivity and ecophysiology of plants at extreme habitats.

4th week

The photosynthesis of plants and its dependence on environmental factors: light responses, light intensity and spectral distribution along light gradients in terrestrial and aquatic habitats. Light adaption and acclimation. The photosynthesis and water relations of plants: deciduous and evergreen strategies; C3, C4 and CAM strategies and their habitat preferences.

5th week

Adaption to water deficiency: soil water reserves and the regulatory mechanisms of water balance in plants. Physiological, anatomical and morphological adaption to soil water deficiency: poikilohydric and homoiohydric plants; glycophytes, halophytes and xerophytes.

6th week

Adaption to temperature extremities: the physiological effects of ambient temperature. Cold stress and freezing. Heat stress. Physiological, anatomical and morphological adaption to temperature extremities.

7th week

The mineral nutrition of plants: environmental factors affecting the availability of mineral nutrients. The role of the plant microbiome (mychorrhiza, N-fixing symbionts). Productivity of different habitats and the limiting factors. The adaption of plants to different soil types. The adaption of plants to oligotrophic habitats.

8th week

The biotic stressors and secondary metabolism of plants: plant-plant interactions and allelopathy, plant defence mechanisms against pathogenes and herbivory.

9th week

Anthropogenic stressors I.: the physiological effects of heavy metals and plant tolerance mechanisms. The practical application of heavy metal tolerance and hyperaccumulation.

10th week

Anthropogenic stressors II.: the physiological and ecological effects of air pollutants. Xenobiotics, basic herbicide modes of action and herbicide tolerance mechanisms.

11th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

12th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

13th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

14th week

Seminar: presentation and discussion of students' projects elaborated on a chosen topic.

Requirements:

- for a signature

Attendance at **lectures** is recommended, but not compulsory.

Participation at **seminars** is compulsory. A student may not miss more than one of the four seminars. In case a student does so, the subject will not be signed and the student must repeat the course. In case of more than one missed seminars a medical certificate needs to be presented. Being late is equivalent with an absence. Active participation is evaluated by the teacher in every seminar class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Each student has to prepare a brief review (~5 pages) on a selected topic and give a short presentation (~15 min) during the seminar classes based on his/her review. The chosen topics will be discussed at the seminars and the reviews will be evaluated by the lecturer. In order to get the signature the reviews must reach at least sufficient level.

- for a grade

The course ends with a **written exam**.

The minimum requirement due to pass the written exam is 50%. The grade for the exam is given according to the following table:

Score	Grade
0-50	fail (1)
51-62	pass (2)
63-75	satisfactory (3)
76-87	good (4)
88-100	excellent (5)

The final grade is calculated as an average of the seminar grade and the exam grade, respectively.

If the score of the exam is below 50%, students can retake the test in line with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

Person responsible for course: Viktor Oláh associate professor, PhD

Lecturers: Viktor Oláh associate professor, PhD, Ilona Mészáros associate professor, PhD