DOCTORAL SCHOOL OF THEORETICAL MEDICINE – TRAINING PLAN

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Professor Ferenc Bari

03/23/2021

Subprogram 1: Neuroendocrinology

Doctoral School of Theoretical Medicine (University of Szeged)

Basic Module 1/subject credit *(min. 38 credits)*													
Basic module													
Course name	**Name of department coordinator**	**Total number of classes**	**Requirements**	**Number of credits in the given semester**								**Total No. of credits**	**Form of evaluation**
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		
Computer-assisted research methodology	Department of Medical Physics and Informatics Prof. Dr. Ferenc Peták	28	C	-	6	-	-	-	-	-	-	6	E5
Scientific communication and publication. Methods, rules, and ethics.	Department of Medical Biology Prof. Dr. Ernő Duda	14	C	-	3	-	-	-	-	-	-	3	E5
Biostatistics Lecture	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	6	-	-	-	-	-	-	-	6	E5
Biostatistics Practice	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	2	-	-	-	-	-	-	-	2	E3
Biomedical Ethics	Department of Behavioral Sciences Dr. Oguz Kelemen	14	C	-	3	-	-	-	-	-	-	3	E5
The total No. of credits in Basic Module 1				**8**	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**20**	

1 C (Compulsory subject)
2 E (Elective subject)
3 CE (Compulsory elective subject)

Compulsory subjects related to the PhD subprogram (specialization)

Neuroendocrinology Subprogram

Course name	Name of department coordinator	Total number of classes	Requirements	Number of credits in the given semester								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
Neuroendocrinology 1 The role of neuropeptides in the central nervous system	Department of Pathophysiology Prof. Dr. Gyula Telegdy, Dr. Zsolt Bagosi	28	C	6	-	-	-	-	-	-	-	6	E5
Chemistry and biochemistry of biopolymers	Departmentof Medical ChemistryProf. Dr. Gabor Tóth	28	C	-	6	-	-	-	-	-	-	6	E5
Neuroendocrinology 2 Neuroendocrine systems under physiological and pathological conditions	Department of Pathophysiology Dr. Zsolt Bagosi	28	C	-	6	-	-	-	-	-	-	6	E5
The total No. of credits for the compulsory subjects in the PhD subprogram (specialization)				6	12	-	-					18	
All compulsory training credits ***(the total No. of credits in the Basic module and for the compulsory subjects related to the PhD subprogram (specialization)***				**8**	**30**	**-**	**-**	**-**	**-**	**-**	**-**	**38**	

Module 2 Research Activity

(min. 130 credits to be accomplished) (30 hours = 1 credit)

Course name	Name of department coordinator	Total number of classes	Requirements	Number of credits in the given semester								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		

Research activity Semesters 1–8 *a total of 300 hours/semester*	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	300	CE	10	10	10	10	10	10	10	10		E3
Research activity Semesters 1–8 *a total of 450 hours/semester*	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	450	CE	15	15	15	15	15	15	15	15		E3
Research activity Semesters 1–8 *a total of 600 hours/semester)*	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	600	CE	20	20	20	20	20	20	20	20		E3
Research report *(Up to 4 times/8 semesters)*	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	14	C	-	3	-	3	-	3	-	3	12	E3
The total No. of credits for the Research activity				min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 130, max. 172	

The total No. of credits for the Training and Research activities:	min. 25, max. 35	min. 33, max. 46	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 168, max. 210	

Module 3 Teaching activity *(max. 8 credits can be given /semester, the total No. of credits: min. 0 credit and max. 48 credits)*

Course name	**Name of department coordinator**	**Total number of**	**Requirements**	**Number of credits in the given semester**								**Total No. of**	**Forrm of evaluation**
				1	2	3	4	5	6	7	8		

		classes										**credits**	
Teaching activity Semesters 1–8 (1 hour/week)	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	14	E	2	2	2	2	2	2	2	2		E3
Teaching activity Semesters 1–8 (2 hours/week)	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	28	E	4	4	4	4	4	4	4	4		E3
Teaching activity Semesters 1 –8 (3 hours/week)	Department of PathophysiologyProf. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	42	E	6	6	6	6	6	6	6	6		E3
Teaching activity Semesters 1 –8 (4 hours/week)	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	56	E	8	8	8	8	8	8	8	8		E3
The total No. of credits for the Teaching activity:				0–8	0–8	0–8	0–8	0–8	0–8	0–8	0–8	min. 0, max. 48	

The total No. of credits for the Compulsory training + Research activity + Teaching activity:	min. 0, max. 43	min. 33, max. 54	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 168, max. 218

Module 4 Publication activity

a training criterion unrelated to semesters (completion: min. 2 items, min. 65 credits, max. 90 credits)

Name of course	**Name of department coordinator**	**Total number of classes**	**Requirements**	**Number of credits in the given semester**								**Total credits**	**Form of evaluation**
				1	2	3	4	5	6	7	8		

Publication in English with no IF (16 hours a week) Semesters 1 –8	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	112	E	20	20	20	20	20	20	20	20		E3
Publication in English with IF (32 hours a week) Semesters 1–8	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	224	C	45	45	45	45	45	45	45	45		E3
Poster presentation at a Hungarian event Semesters 1–8	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	14	E	3	3	3	3	3	3	3	3		E3
Poster presentation at an international event (Hungary incl.) Semesters 1–8	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	28	E	5	5	5	5	5	5	5	5		E3
Oral presentation at a Hungarian event Semesters 1–8	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	14	E	3	3	3	3	3	3	3	3		E3
Oral presentation at an international event Semesters 1–8	Department of Pathophysiology Prof. Dr. Gyula Telegdy and Dr. Zsolt Bagosi	28	E	5	5	5	5	5	5	5	5		E3

The total No. of credits for the Publication activity:		**65–81**	

The total No. of credits in Modules 1–4: completion of min. 20, max. 45 credits / semester**;** the total No. of min. 240 credits / 8 semesters; max. 360 credits / 8 semesters	***min. 233, max. 289**	

A total No. of min. 240 credits / 8 semesters is required including optional courses (preferably courses offered by the graduate schools of the MSc, which are included in a separate description) –7 credits.

Compulsory subjects (Semesters 1–4)

1. Biostatistics Lecture 28 hours – 6 credits
2. Biostatistics Practice 28 hours - 2 credits

Total No. of credits in Semester 1: 8 credits

3. Computer-assisted research methodology 28 hours – 6 credits
4. Scientific literature 14 hours – 3 credits
5. Biomedical Ethics 14 hours – 3 credits

Total No. of credits in Semester 2: 12 credits

Compulsory subjects related to the PhD subprogram (specialization) (Semesters 1–4)

Subprogram 1: Neuroendocrinology

1. Neuroendocrinology 1
   The role of neuropeptides in the central nervous system (Semester 2 or 4) 28 hours – 6 credits
2. Chemistry and biochemistry of biopolymers (Semester 2 or 4) 28 hours – 6 credits
3. Neuroendocrinology 2
   Neuroendocrine systems under physiological and pathological conditions (Semester 2 or 4)
   28 hours – 6 credits

Total No. of credits in Semester 4: 18 credits

Elective Subjects (Semesters 1–4)

Exciting trends in Molecular Biology (coordinator: Prof. Sandor BENYHE, Ildiko KARCAGI Institute of Biochemistry, ELKH Biological Research Centre) 28 hour 6 credit spring semester

The training plan consists of 4 parts (modules).

STUDY REQUIREMENTS

General Rules:

- Minimum 18 and maximum 45 credits should be earned in each semester.
- Minimum 90 credits should be earned in Semesters 1–4, min. 90 credits are required for the admission to the complex examination.
- Students should earn minimum 240 credits during the 8 semesters (2 + 2 years).
- For doing teaching activity, 8 credits can be given per semester, up to a total of 48 credits.
- Research report: 3 credits for each; minimum 1 maximum 4 reports can be rewarded by a total of 12 credits.

Requirements for the complex examination:

The complex examination must be completed at the end of Year 2 (Semester 4).
Sum of all compulsory training credits (basic and subprogram (specialization) credits: 20 + 18 = 38 credits)
Compulsory subjects of the 4 subprograms of the Doctoral School of Theoretical Medicine, University of Szeged, of which min. 18 credits must be collected in Semesters 1–4.

Compulsory subject 1
Details of the course

Subject area:	**Phd course**
Name of course:	**Neuroendcrinology 1 - The role of neuropeptides in the central nervous system**

Name of department:	Department of Pathophysiology, University of Szeged
Coordinators:	Dr. Zsolt Bagosi, Dr. Krisztina Csabafi, Dr. Miklós Jászberényi
Course requirement:	no
Course announcement (Fall or Spring semester)	Fall – Semester 1
Suggested course registration:	Fall semester
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-point grading system
Maximumum number of course registrations:	1
Department announcing the course:	Department of Pathophysiology, University of Szeged
Type of course:	theoretical
Type of examination:	oral
Lecturers of the course:	Dr. Zsolt Bagosi, Dr. Krisztina Csabafi, Dr. Miklós Jászberényi
* Topics of the course:	1. The regulation of the hypothalamic–pituitary–adrenal (HPA) axis 2. The investigation of the HPA axis 3. The role of ghrelin and obestatin in the regulation of the HPA axis 4. The role of ghrelin and obestatin in the regulation of the brain–gut system 5. The role of urocortins in the regulation of the HPA axis 6. The role of urocortins in the regulation of the hippocampal–hypothalamic–amygdalar system 7. The role of urocortins in social interaction 8. The role of urocortins in drug addiction 9. The role of kisspeptin in the regulation of the HPA axis 10. The role of kisspeptin in anxiety and depression 11. The role of kisspeptin in the regulation of the HPA axis 12. The role of kisspeptin in the regulation of pain 13. The pathopyhsiology of Alzheimer's disease 14. The investigation of Alzheimer's disease
*Required reading:	Handbook of Neuroendocrinology 1st Edition, Academic Press, 2011

Compulsory subject 2
Details of the course

Subject area:	Bioorganic Chemistry
Name of course	**Chemistry and biochemistry of biopolymers**
Name of department:	Department of Medical Chemistry, University of Szeged
Coordinator:	Prof. Dr. Gábor Tóth
Course requirement:	no
Course announcement (Fall or Spring semester)	Spring – Semester 2
Suggested course registration:	Spring semester
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-point grading system
Maximum number of course registrations:	1
Department announcing the course:	Department of Medical Chemistry, University of Szeged
Type of course:	theoretical
Type of examination:	oral
Lecturers of the course:	Prof. Dr. Gábor Tóth, Prof. Dr. Botond Penke, Prof. Dr. Tamás Martinek, Dr. Györgyi Váradi, Dr. Zoltán Kele, Dr. Ferenc Bogár
* Topics of the course:	Building blocks of biopolymers, synthesis, labelling, and precursors Protecting groups, preparation, deprotection, and compatibility Peptide coupling, synthetic strategies, advantages and limitations Principles of solid-phase synthesis, automation, and resins Synthesis of posttranslationally modified peptides Oligonucleotide synthesis Isolation and structural proof of synthetic biopolymers Carbohydrates and polysaccharides Application of biopolymers in research and in the pharmaceutical industry Biologically active peptides, agonists, and antagonists Enzyme inhibitors and peptidemimetics Three dimensional structures of biopolymers, its investigation, and NMR spectroscopy Molecular mechanics and molecular dinamics approaches

	Connection between conformation and pathology
*Required reading:	- theses accepted in the program (postdoctorial, PhD and Doctor of the Hungarian Academy), - target scientific articles available in PubMed - course and lecture notes available on the website of the department.

Compulsory subject 3
Details of the course

Subject area:	**PhD course**
Name of course	**Neuroendocrinology 2 -**Neuroendocrine systems under physiological and pathological conditions
Name of department:	Department of Pathophysiology, University of Szeged
Coordinators:	Dr. Zsolt Bagosi, Dr. Krisztina Csabafi, Dr. Miklós Jászberényi
Course requirement:	no
Course announcement	Spring – Semester 2
Suggested course registration:	Spring semester
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-point grading system
Maximum number of course registrations:	1
Department announcing the course:	Department of Pathophysiology, University of Szeged
Type of course:	theoretical
Type of examination:	oral
Lecturers of the course:	
* Topics of the course:	1. The hypothalamic–pituitary–adrenal system 2. The renin–angiotensin–aldosterone system 3. The hypothalamic–pituitary–thyroid gland system 4. The hypothalamic–pituitary–gonadal system 5. Prolactin 6. Growth hormone 7. Oxytocin and vasopressin 8. Kisspeptin and other RF-amides 9. The urocortins 10. The neuromedins

	11. Ghrelin, leptin, and the modulation of appetite 12. Substance-P, neurokinins and the modulation of pain 13. Endomorphins and other endogenous opioids 14. The natriuretic peptides
*Required reading:	Williams Textbook of Endocrinology 13th Edition, Elsevier, 2015

Elective subject

Subprogram 2: Neuroscience
Doctoral School of Theoretical Medicine (University of Szeged)

Basic Module 1/subject credit *(min. 38 credits)*													
Basic module													
Course name	**Name of department coordinator**	**Total number of classes (hours)**	**Requirements**	**Number of credits in the given semesters**								**Total No. of credits**	**Form of valuation**
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		
Computer-assisted research methodology	Department of Medical Physics and Informatics Prof. Dr. Ferenc Peták	28	C	-	6	-	-	-	-	-	-	6	E5
Scientific communication and publication. Methods, rules, and ethics.	Department of Medical Biology Prof. Dr. Ernő Duda	14	C	-	3	-	-	-	-	-	-	3	E5
Biostatistics Lecture	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	6	-	-	-	-	-	-	-	6	E5
Biostatistics Practice	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	2	-	-	-	-	-	-	-	2	E3

Biomedical Ethics	Department of Behavioral Scientes Dr. Oguz Kelemen	14	C	-	3	-	-	-	-	-	-	3	E5
The total No. of credits in Basic Module 1				**8**	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**20**	

1 C (Compulsory subject)
2 E (Elective subject)
3 CE (Compulsory elective subject)

Compulsory subjects related to the PhD subprogram (specialization)													
Neuroscience Subprogram													
Course name	**Name of department coordinator**	**Total number of classes (hours)**	**Requirements**	**Number of credits in the given semesters**								**Total No. of credits**	**Form of evaluation**
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		
Neurophysiology 1	Department of Physiology, Faculty of Medicine Dr. Peter Santha	28	C	6	-	-	-	-	-	-	-	6	E5
Neurophysiology 2	Department of Physiology, Faculty of Medicine Dr. Peter Santha	28	C	-	6	-	-	-	-	-	-	6	E5
Neuroanatomy	Department of Anatomy, Histology, and Embryology Prof. Antal Nógradi	28	C		**6**	-	-	-	-	-	-	6	E5
The total No. of credits for the compulsory subjects in the PhD subprogram (specialization)				6	12	-	-					18	
All compulsory training credits ***(The total No. of credits in the Basic module and for the compulsory subjects related to the PhD subprogram (specialization)***				**14**	**24**	**-**	**-**	**-**	**-**	**-**	**-**	**38**	

Module 2 Research Activity

(min. 130 credits to be achieved) (30 hours = 1 credit)

Course name	Name of department coordinator	total number of classes	requirements	Number of credits in the given semesters								total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
Research activity Semesters 1–8 *total No. of 300 hours/semester*	Department of Medical Physics and Informatics Prof. Ferenc Bari	300	CE	10	10	10	10	10	10	10	10		E3
Research activity Semesters 1–8 *total No. of 450 hours/semester*	Department of Medical Physics and Informatics Prof. Ferenc Bari	450	CE	15	15	15	15	15	15	15	15		E3
Research activity Semesters 1–8 *total No. of 600 hours/semester)*	Department of Medical Physics and Informatics Prof. Ferenc Bari	600	CE	20	20	20	20	20	20	20	20		E3
Research report *(Up to 4*	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	C	-	3	-	3	-	3	-	3	12	E3

times/8 semester													
The total No. of credits for the Research activity				min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 130, max. 172	

The total No. of credits for the Training and Research activities:	min. 25, max. 35	min. 33, max. 46	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 168, max. 210	

Module 3 Teaching activity *(max. 8 credits can be given /semester, The total No. of min. 0 credit and max. 48 credits)*

Course name	Name of department coordinator	Total number of classes (hours)	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1.	2.	3.	4.	5.	6.	7.	8.		
Teaching activity Semesters 1–8 (1 hour/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	2	2	2	2	2	2	2	2		E3
Teaching activity Semesters 1–8 (2 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	4	4	4	4	4	4	4	4		E3
Teaching activity Semesters 1–8 (3 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	42	E	6	6	6	6	6	6	6	6		E3
Teaching activity Semesters 1–8 (4 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	56	E	8	8	8	8	8	8	8	8		E3
The total No. of credits for the Teaching activity:				0–8	0–8	0–8	0–8	0–8	0–8	0–8	0–8	min. 0, max. 48	

The total No. of credits for the Compulsory training + Research activity + Teaching activity:	min. 0, max. 43	min. 33, max. 54	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 168, max. 218

Module 4 Publication activity

a training criterion unrelated to semesters (completion: min. 2 items, min. 65 credits, max. 90 credits)

Course name	Name of department coordinator	Total number of classes (hours)	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
publication in English with no IF (16 hours a week) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	112	E	20	20	20	20	20	20	20	20		E3
publication in English with IF (32 hours a week) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	224	C	45	45	45	45	45	45	45	45		E3
poster presentation at a Hungarian event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	3	3	3	3	3	3	3	3		E3
poster presentation at an international event (Hungary incl.) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	5	5	5	5	5	5	5	5		E3
oral presentation at a Hungarian event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	3	3	3	3	3	3	3	3		E3
oral presentation at an international event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	5	5	5	5	5	5	5	5		E3

The total No. of credits for the Publication activity:		**65–81**	

The total No. of credits in Modules 1–4: completion of min. 20, max. 45 credits / semester**;** The total No. of min. 240 credits / 8 semesters; max. 360 credits / 8 semesters	***min. 233, max. 289**	

A total No. of min. 240 credits / 8 semesters is required including optional courses (preferably courses offered by the graduate schools of the MSc, which are included in a separate description – 7 credits).

Compulsory subjects (Semesters 1–4)

1. Biostatistics Lecture 28 hours – 6 credits
2. Biostatistics Practical 28 hours – 2 credits

Total No. of credits in Semester 1: 8 credit

3. Computer-assisted research methodology 28 hours – 6 credits
4. Scientific literature 14 hours – 3 credits
5. Biomedical Ethics 14 hours – 3 credits

Total No. of credits in Semester 2: 12 credits

Compulsory subjects related to the PhD subprogram (specialization) (Semesters 1–4)

Subprogram 2: Neuroscience

1. Neurophysiology 1 (Semester 1 or 3) 28 hours – 6 credits
2. Neurophysiology 2 (Semester 2 or 4) 28 hours – 6 credits
3. Neuroanatomy 28 hours – 6 credits

Total No. of credits in Semester 4: 18 credits

Elective Subjects (Semesters 1–4)

Exciting trends in Molecular Biology (coordinator: Prof. Sandor BENYHE, Ildiko KARCAGI Institute of Biochemistry, ELKH Biological Research Centre 28 hour 6 credit spring semester)

The training plan consists of 4 parts (modules).

STUDY REQUIREMENTS

General Rules:

- Minimum 20 and maximum 45 credits should be earned in each semester.
- Minimum 90 credits should be earned in Semesters 1–4, and min. 90 credits are required for the admission to the complex examination.
- Students should earn minimum 240 credits during the 8 semesters (2 + 2 years).
- For doing teaching activity, 8 credits can be given per semester, up to a total of 48 credits.
- Research report: 3 credits for each; minimum 1 maximum 4 reports can be rewarded by a total of 12 credits.

Requirements for the complex examination:

The complex examination must be completed at the end of Year 2 (Semester 4).
The sum of all compulsory training credits (basic and subprogram (specialization) credits: 20 + 18 = 38 credits).
Compulsory subjects of the 4 subprograms of the Doctoral School of Theoretical Medicine, University of Szeged, of which min. 18 credits must be collected in Semesters 1–4.

Compulsory subject 1
Details of the course

Subject area:	Neurophysiology
Course name:	**Neurophysiology 1**
Name of department:	Department of Physiology, Faculty of Medicine, University of Szeged
Coordinator:	Péter Sántha, MD, PhD
Course requirement:	No
Course announcement (Fall or Spring semester)	Fall semester
Suggested course registration:	3rd semester of the PhD training
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	Oral/written examination (5-point grade)
Maximum number of course registrations:	1
Department announcing the course:	Department of Physiology, Faculty of medicine, University of Szeged
Type of course:	Theoretical (lectures)
Type of examination:	Oral/written
Lecturers of the course:	Dr. Gábor Jancsó, Dr. Mária Dux, Dr. Péter Sántha, Dr. Gyula Sáry, Dr. Attila Nagy, Dr. Szabolcs Kéri, Dr. Antal Berényi, Dr. Ferenc Domoki
Topics of the course:	1. Membrane physiology – the basics of cellular neurophysiology Transmembrane transport processes, functions of the ion pumps and channels, resting membrane potential, electrotonic (graded) membrane potentials, action potential, and propagation of the AP 2. Synaptic transmission Structure of the chemical and electrical synapses, neurotransmitters, molecular mechanism of the release and actions of neurotransmitters, synthesis and inactivation of the neurotransmitters, ionic mechanisms of the postsynaptic

	potentials/currents, pre- and postsynaptic facilitation and inhibition, modulation of the synaptic strength, and synaptic plasticity 3. Cellular aspects of the sensory transduction process Classification of sensory receptor cells, molecular mechanisms of the sensory transduction, generator (sensory) potential, encoding of the sensory signal, receptive field, spatial and temporal resolution, and functional morphology of the primary sensory neuron 4. Peripheral organisation of the autonomic nervous system (ANS) Divisions of the ANS, organisation of the spinal cord segment, autonomic afferents and efferents, principal neurotransmitters in the ANS, origin of the autonomic tone, basic principles of the autonomic reflexes, main actions of the ANS on body functions, and pharmacological and non-pharmacological manipulation of the autonomic functions 5. Neuromuscular transmission Functional morphology of the neuromuscular junction (motor end plate), functional properties of motoneurons, biochemistry and pharmacology of the cholinergic transmission, end plate potential, excitation–contraction coupling, and regulation of the muscle contraction and force generation
Required reading:	Purves et al.: Neuroscience 2nd ed. (https://www.ncbi.nlm.nih.gov/books/NBK10799/?term=Pruves) Kandel, Schwartz, Jessel: Principles of Neural Science Illustrations of the lectures will be available on the web page of the Institute (http://www.phys.szote.u-szeged.hu/index.php?lap=2&id=en&kf=m)

Compulsory subject 2
Details of the course

Subject area:	Neurophysiology
Course name:	**Neurophysiology 2**
Name of department:	Department of Physiology, Faculty of Medicine, University of Szeged
Coordinator:	Péter Sántha, MD, PhD
Course requirement:	No

Course announcement (Fall or Spring semester)	Spring semester
Suggested course registration	Semester 4 of the PhD training
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	Oral/written examination (5-point grade)
Maximum number of course registrations:	1
Department announcing the course:	Department of Physiology, Faculty of medicine, University of Szeged
Type of course:	Theoretical (lectures)
Type of examination:	Oral/written
Lecturers of the course:	Dr. Gábor Jancsó, Dr. Mária Dux, Dr. Péter Sántha, Dr. Gyula Sáry, Dr. Attila Nagy, Dr. Szabolcs Kéri, Dr. Antal Berényi, Dr. Ferenc Domoki
Topics of the course:	Central Nervous System – Introduction Meninges. Water compartments, blood circulation and metabolism of the brain Physiology of the somatosensory functions Pain perception, neurobiology of nociception Chemical senses: smell and taste Hearing and the vestibular system The physiology of vision Neural organisation of the somatomotor system Central organisation of the autonomic nervous system Integration of neurovegetative control Functions of the limbic system: emotions, motivation, and reward Collective electrical activity of neuron assemblies: EEG waves, sensory evoked potentials Sleep mechanisms and circadian rhythms Memory functions – neural mechanisms of learning Hemispherical representation of neural functions Physiological correlates of language and speech Functional organisation of cortical areas. Columnal organisation of the neocortex
Required reading:	Pruves et al.: Neuroscience 2nd ed. (https://www.ncbi.nlm.nih.gov/books/NBK10799/?term=Pruves) Kandel, Schwartz, Jessel: Principles of Neural Science Illustrations of the lectures will be available on the web page of the Institute (http://www.phys.szote.u-szeged.hu/index.php?lap=2&id=en&kf=m)

Compulsory subject 3

Details of the course

Subject area:	Neurology
Name of course	Neuroanatomy
Name of department:	Department of Anatomy, Histology, and Embryology, Faculty of Medicine, University of Szeged
Coordinator:	Prof. Dr. Antal Nógrádi
Course requirement:	no
Course announcement (Fall or Spring semester)	Fall Semester
Suggested course registration:	Semester 1 or 3
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-point grade
Maximum number of course registrations:	1 (the course cannot be repeated)
Department announcing the course:	Department of Anatomy, Histology, and Embryology, Faculty of Medicine, University of Szeged
Type of course:	theoretical
Type of examination:	oral examination
Lecturers of the course:	Dr. Antal Nógrádi, Dr. András Mihály András, Dr. Krisztián Pajer
* Topics of the course:	Approaches to the structure and function of the nervous system: a historical overview Methods applied in the examination of the nervous system: clinical and pathological observations, experimental approaches, methods of examination in neuroanatomy and neurobiology The development of the central and peripheral nervous systems The organization of the nervous system, macroscopic anatomy of the central nervous system (parts of the CNS, the structure of the meninges, production, circulation and absorption of the cerebrospinal fluid, and cerebral blood supply) Microscopic structure of the nervous system. Parts of the neurons and their optical and electron microscopic structures. The neuron as a unit, continuity and contiguity. The role and morphology of glia cells. Degeneration and regeneration in the nervous system, and plasticity in the nervous system. Types of damages in the nervous system, possibility of reconstruction in the nervous system, and transplantation of nerve tissue. Macroscopic anatomy of the spinal cord, meninges of the spinal cord (the description and importance of the dural sac and the

	epidural space), the structure of the spinal segment, the definition of segment and dermatome. Cytoarchitectonics of the spinal cord, rexed laminae, cell types of the spinal cord, and the structure of spinal reflex arcs The diencephalon, thalamus, thalamic nuclei and their network Structure of the cerebrum and the cerebral cortex, and the cortical network Structure of the cerebellum and the cerebellar cortex, afferent and efferent pathways of the cerebellum Organization of the motor system, the pyramidal motor systemThe somatosensory system, protopathic and epicritic modalities, plasticity in sensory systems Hypothalamus, hypothalamus—pituitary complex, neurosecretion
*Required reading:	Szentágothai–Réthelyi: Functionalis anatomia [Functional Anatomy] III. kötet [Volume 3]

Elective subject

Subprogram 3: Gastroenterology

Doctoral School of Theoretical Medicine (University of Szeged)

Basic Module 1/subject credit *(min. 38 credits)*													
Basic module													
Course name	**Name of department coordinator**	**Total number of classes**	**Requirements**	**Number of credits in the given semester**								**Total No. of credits**	**Form of evaluation**
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		
Computer-assisted research methodology	Department of Medical Physics and Informatics Prof. Dr. Ferenc Peták	28	C	-	6	-	-	-	-	-	-	6	E5
Scientific communication and publication.	Department of Medical Biology	14	C	-	3	-	-	-	-	-	-	3	E5

Methods, rules, and ethics.	Prof. Dr. Ernő Duda												
Biostatistics Lecture	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	6	-	-	-	-	-	-	-	6	E5
Biostatistics Practice	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	2	-	-	-	-	-	-	-	2	E3
Biomedical Ethics	Department of Behavioral Sciences Dr. Oguz Kelemen	14	C	-	3	-	-	-	-	-	-	3	E5
The total No. of credits in Basic Module 1				**8**	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**20**	

1 C (Compulsory subject)
2 E (Elective subject)
3 CE (Compulsory elective subject)

Compulsory subjects related to the PhD subprogram (specialization)

Gastroenterology Subprogram

Course name	Name of department coordinator	Total number of classes	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
Endocrinology of the gastrointestinal system	1st Department of Internal Medicine Dr. Janos Gardi	28	C	-	6	-	-	-	-	-	-	6	E5
Molecular physiology and pathophysiology of the gastrointestinal system	Department of Pharmacology and Pharmacotherapy Dr. Viktoria Venglovecz	28	C	-	6	-	-	-	-	-	-	6	E5
Modern diagnostic and therapeutic endoscopy	1st Department of Internal Medicine	28	C	-	6	-	-	-	-	-	-	6	E5

	Prof. Laszlo Czakó												
The total No. of credits for the compulsory subjects in the PhD subprogram (specialization)				-	12	-	-					18	
***All compulsory trainings credits** (The total No. of credits in the Basic module and for the compulsory subjects related to the PhD subprogram (specialization)*				**14**	**24**	**-**	**-**	**-**	**-**	**-**	**-**	**38**	

Module 2 Research Activity

(min. 130 credits) (30 hours = 1 credit)

Course name	Name of department coordinator	Total number of classes (hours)	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
Research activity Semesters 1–8 *total No. of 300 hours/semseter*	Department of Medical Physics and Informatics Prof. Ferenc Bari	300	CE	10	10	10	10	10	10	10	10		E3
Research activity Semesters 1–8 *total No. of 450 hours/semseter*	Department of Medical Physics and Informatics Prof. Ferenc Bari	450	CE	15	15	15	15	15	15	15	15		E3
Research activity Semesters 1–8 *total No. of 600 hours/semseter*	Department of Medical Physics and Informatics Prof. Ferenc Bari	600	CE	20	20	20	20	20	20	20	20		E3
Research report *(Up to 4*	Department of Medical Physics and Informatics	14	C	-	3	-	3	-	3	-	3	12	E3

times/8 semesters)	Prof. Ferenc Bari												
The total No. of credits for the Research activity				min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 130, max. 172	

The total No. of credits for the Training and Research activities:	min. 25, max. 35	min. 33, max. 46	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 10, max. 20	min. 10, max. 23	min. 168, max. 210	

Module 3 Teaching activity *(max. 8 credit /semester can be given, The total No. of min. 0 credit and max. 48 credits)*

Course name	**Name of department coordinator**	**Total number of classes**	**Requirements**	**Number of credits in the given semesters**								**Total No. of credits**	**Form of evaluation**
				1.	2.	3.	4.	5.	6.	7.	8.		
Teaching activity Semesters 1–8 (1 hour/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	2	2	2	2	2	2	2	2		E3
Teaching activity Semesters 1–8 (2 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	4	4	4	4	4	4	4	4		E3
Teaching activity Semesters 1–8 (3 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	42	E	6	6	6	6	6	6	6	6		E3
Teaching activity Semesters 1–8 (4 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	56	E	8	8	8	8	8	8	8	8		E3

The total No. of credits for the Teaching activity:	0–8	0–8	0–8	0–8	0–8	0–8	0–8	0–8	min. 0 max. 48	

The total No. of credits for the Compulsory training + Research activity + Teaching activity:	min. 0, max. 43	min. 33, max. 54	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 168, max. 218

Module 4 Publication activity

a training criterion unrelated to semesters (completion: min. 2 items, min. 65 credits, max. 90 credits)

Name of course	Name of department coordinator	Total number of classes	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*		
publication in English with no IF (16 hours a week) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	112	E	20	20	20	20	20	20	20	20		E3
publication in English with IF (32 hours a week) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	224	C	45	45	45	45	45	45	45	45		E3
poster presentation at a Hungarian event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	3	3	3	3	3	3	3	3		E3
poster presentation at an international event (Hungary incl.) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	5	5	5	5	5	5	5	5		E3
oral presentation at a Hungarian event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	3	3	3	3	3	3	3	3		E3
oral presentation at an international event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	5	5	5	5	5	5	5	5		E3

The total No. of credits for the Publication activity:		**65–81**	

The total No. of credits in Modules 1–4: completion of min. 20, max. 45 credits / semester**;** The total No. of min. 240 credits / 8 semesters; max. 360 credits / 8 semesters	***min. 233, max. 289**	

The total No. of min. 240 credits / 8 semesters (7 credits are required from optional courses, preferably courses offered by the graduate schools of the MSc, which are included in a separate description)

Compulsory subjects (Semesters 1–4)

1. Biostatistics Lecture 28 hours – 6 credits
2. Biostatistics Practice 28 hours - 2 credits

i. Total No. of credits in Semester 1: 8 credits

3. Computer-assisted research methodology 28 hours – 6 credits
4. Scientific literature 14 hours – 3 credits
5. Biomedical Ethics 14 hours – 3 credits

Total No. of credits in Semester 2: 12 credits

Compulsory subjects related to the PhD subprogram (specialization) (Semesters 1–4)

Subprogram 3: Gastroenterology

1. Endocrinology of the gastrointestinal system (Semester 2 or 4) 28 hours – 6 credits
2. Molecular physiology and pathophysiology of the gastrointestinal system (Semester 2 or 4) 28 hours – 6 credits
3. Modern diagnostic and therapeutic endoscopy (Semester 2 or 4) 28 hours – 6 credits

Total No. of credits in Semester 4: 18 credits

Elective Subjects (Semesters 1–4)

Exciting trends in Molecular Biology (coordinator: Prof. Sandor BENYHE, Ildiko KARCAGI Institute of Biochemistry, ELKH Biological Research Centre) 28 hour 6 credit spring semester)

The training plan consists of 4 parts (modules).

STUDY REQUIREMENTS

General Rules:

Minimum 20 and maximum 45 credits should be earned in each semester.

- Minimum 90 credits should be earned in Semesters 1–4, and min. 90 credits are required for the admission to the complex examination.

- Students should earn minimum 240 credits during the 8 semesters (2 + 2 years).

- For doing teaching activity, 8 credits can be given per semester, up to a total of 48 credits.

- Research report: 3 credits for each; minimum 1 maximum 4 reports can be rewarded by a total of 12 credits.

Requirements for the complex examination:

The complex examination must be completed at the end of Year 2 (Semester 4).
The sum of all compulsory education credits (basic and subprogram (specialization) credits: 20 + 18 = 38 credits)
Compulsory subjects of the 4 subprograms of the Doctoral School of Theoretical Medicine, University of Szeged, of which min. 18 credits must be collected in Semesters 1–4.

Compulsory subject 1
Details of the course

Subject area:	Doctoral School of Theoretical Medicine
Course name:	**Endocrinology of the gastrointestinal system**
Name of department:	1st Department of Internal Medicine
Coordinator:	János Gardi, Phd
Course requirement:	NA
Course announcement (Fall or Spring semester)	Spring
Suggested course registration:	Spring
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	examination
Maximum number of course registrations:	1
Department announcing the course:	1st Department of Internal Medicine
Type of course:	theoretical and practical
Type of examination:	oral
Lecturers of the course:	Dr. János Gardi, Prof. László Czakó, Prof. Dr. Péter Hegyi, Prof. Dr. Tamás Molnár, Prof. Zoltán Rakonczay, Dr. József Maléth, Dr. András Rosztóczy, Dr. Richárd Róka, Dr. Viktória Venglovecz, Dr. Klaudia Farkas
Topics of the course:	1. Gastrointestinal physiology

	2. Neurohormonal regulation in the gastrointestinal system 3. Gastrointestinal hormones and neuropeptides 4. Measurement of gastrointestinal hormones and neuropeptides 5. Synthesis of the antagonists of gastrointestinal hormones and neuropeptides 6. Clinical application of gastrointestinal hormones and neuropeptides 7. Pharmacology of the gastrointestinal tract
Required reading:	relevant articles in PubMed

Compulsory subject 2
Details of the course

Subject area:	Doctoral School of Theoretical Medicine
Course name:	**Molecular physiology and pathophysiology of the gastrointestinal system**
Name of department:	Department of Pharmacology and Pharmacotherapy, University of Szeged
Coordinator:	Viktória Venglovecz dr.
Course requirement:	no
Course announcement (Fall or Spring semester)	Spring semester
Suggested course registration:	Spring semester
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	Multiple choice questions
Maximum number of course registrations:	1
Department announcing the course:	1st Department of Internal Medicine, University of Szeged
Department of Pharmacology and Pharmacotherapy, University of Szeged	theoretical
Theoretical/practical	oral Written (multiple choice questions)
Lecturers of the course:	Max. 15
Topics of the course:	Basic cell physiological knowledge in gastroenterology Physiological function of epithelial cells Ion transport processes in the gastrointestinal tract Modern cell physiological techniques

	Study of pathophysiological processes of the exocrine and endocrine pancreas
Required reading:	- Ph.D. and MTA doctoral theses accepted so far in the program - Targeted PubMed search downloads - Relevant chapters of lectures and books on the Institute's website

Compulsory subject 3
Details of the course

Subject area:	Doctoral School of Theoretical Medicine
Course name:	**Modern diagnostic and therapeutic endoscopy**
Name of department:	1st Department of Internal Medicine
Coordinator:	László Czakó, MD, Phd, DSc, MSc
Course requirement:	NA
Course announcement (Fall or Spring semester)	Spring
Suggested course registration:	Spring
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	examination
Maximum number of course registrations:	1
Department announcing the course::	1st Department of Internal Medicine
Type of course:	theoretical and practical
Type of examination:	oral
Lecturers of the course:	Prof. László Czakó, Prof. Tamás Molnár, Dr. Zoltán Szepes, Dr. András Rosztóczy, Dr. Richárd Róka, Dr. Mátyás Czepán, Dr. Klaudia Farkas
Topics of the course:	1. General principles in endoscopy 2. Special endoscopic imaging methods 3. Esophagogastroduodenoscopy 4. Colonoscopy 4. Endoscopy of the small bowels 5. ERCP: biliary endoscopy 6. ERCP: pancreatic endoscopy 7. Diagnostic and therapeutic endoscopic ultrasound 7. Therapy of early GI malignancies 9. Natural orifice translumenal endoscopic surgery (NOTES) 10. Performance measures in endoscopy. Endoscopic education

	11. Visit to the Skills Lab
Required reading:	- Elmunzer V, Khashab MA, Muthusamy VR: Clinical Gastrointestinal Endoscopy - Chun HJ, Yang S, Choi MG: Therapeutic Gastrointestinal Endoscopy - recent literature in Pubmed

Subprogram 4: *Regulation, measurement, and analysis of life processes*

Doctoral School of Theoretical Medicine (University of Szeged)[1]

Basic Module 1/subject credit *(min. 38 credits)*													
Basic module													
Course name	**Name of department coordinator**	**Total number of classes**	**Requirements**	**Number of credits in the given semester**								**Total No. of credits**	**Form of evaluation**
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**		
Computer-assisted research methodology	Department of Medical Physics and Informatics Prof. Dr. Ferenc Peták	28	C	-	6	-	-	-	-	-	-	6	E5
Scientific communication and publication. Methods, rules, and ethics.	Department of Medical Biology Prof. Dr. Ernő Duda	14	C	-	3	-	-	-	-	-	-	3	E5
Biostatistics Lecture	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	6	-	-	-	-	-	-	-	6	E5
Biostatistics Practice	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	2	-	-	-	-	-	-	-	2	E3
Biomedical Ethics	Department of Behavioral Sciences Dr. Oguz Kelemen	14	C	-	3	-	-	-	-	-	-	3	E5
The total No. of credits in Basic Module 1				**8**	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**20**	

[1]

1 C (Compulsory subject)
2 E (Elective subject)
3 CE (Compulsory elective subject)

Compulsory subjects related to the PhD subprogram (specialization)													
Regulation, measurement, and analysis of life processes subprogram													
Course name	**Name of department coordinator**	**Classes/ semester**	**Requirements**	**Number of credits in the given semesters**								**Total No. of credits**	**Form of evaluation**
				1	2	3	4	5	6	7	8		
Measurement of life processes	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	C	6	-	-	-	-	-	-	-	6	E5
Modern information technologies in medicine	Department of Medical Physics and Informatics Prof. Ferenc Peták	28	C	-	6	-	-	-	-	-	-	6	E5
Processing and analysis of measurement data	Department of Medical Physics and Informatics Dr Péter Makra	28	C	-	6	-	-	-	-	-	-	6	E5
The total No. of credits for the compulsory subjects in the PhD subprogram (specialization)				6	12	-	-					18	
All compulsory training credits ***(The total No. of credits in the Basic module and for the compulsory subjects related to the PhD subprogram (specialization)***				**14**	**24**	**-**	**-**	**-**	**-**	**-**	**-**	**38**	

Module 2 Research Activity

(min. 130 credits) (30 hours = 1 credit)

Course name	**Name of department coordinator**	**Classes/ semester**	**Require**	**Number of credits in the given semesters**	**Total No. of credits**	**Form of eval**

			ments										uation
				1	2	3	4	5	6	7	8		
Research activity Semesters 1–8 *total No. of 300 hours/semseter*	Department of Medical Physics and Informatics Prof. Ferenc Bari	300	CE	10	10	10	10	10	10	10	10		E3
Research activity Semesters 1–8 *total No. of 450 hours/semseter*	Department of Medical Physics and Informatics Prof. Ferenc Bari	450	CE	15	15	15	15	15	15	15	15		E3
Research activity Semesters 1–8 *total No. of 600 hours/semseter*	Department of Medical Physics and Informatics Prof. Ferenc Bari	600	CE	20	20	20	20	20	20	20	20		E3
Research report *(Up to 4 times/8 semesters)*	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	C	-	3	-	3	-	3	-	3	12	E3

Module 3 Teaching activity *(max. 8 credits/semester can be given, The total No. of min. 0 credit, max. 48 credits)*

Course name	Name of department coordinator	Classes/ semester	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1.	2.	3.	4.	5.	6.	7.	8.		
Teaching activity Semesters 1–8 (1 hour/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	2	2	2	2	2	2	2	2		E3
Teaching activity Semesters 1–8 (2 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	4	4	4	4	4	4	4	4		E3
Teaching activity Semesters 1–8 (3 hours/week)	Department of Medical	42	E	6	6	6	6	6	6	6	6		E3

	Physics and Informatics Prof. Ferenc Bari												
Teaching activity Semesters 1–8 (4 hours/week)	Department of Medical Physics and Informatics Prof. Ferenc Bari	56	E	8	8	8	8	8	8	8	8		E3
The total No. of credits for the Teaching activity:				0–8	0–8	0–8	0–8	0–8	0–8	0–8	0–8	min. 0, max. 48	

The total No. of credits for the Compulsory training + Research activity + Teaching activity:	min. 0, max. 43	min. 33, max. 54	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 10, max. 28	min. 10, max. 31	min. 168, max. 218

Module 4 Publication Activity

a training criterion unrelated to semesters (completion: min. 2 items, min. 65 credits, max. 90 credits)

Name of course	Name of department coordinator	Classes / semester	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
publication in English with no IF (16 hours a week) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	112	E	20	20	20	20	20	20	20	20		E3
publication in English with IF (32 hours a week) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	224	C	45	45	45	45	45	45	45	45		E3
poster presentation at a Hungarian event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	3	3	3	3	3	3	3	3		E3
poster presentation at an international event (Hungary incl.) Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	5	5	5	5	5	5	5	5		E3
oral presentation at a Hungarian event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	14	E	3	3	3	3	3	3	3	3		E3

oral presentation at an international event Semesters 1–8	Department of Medical Physics and Informatics Prof. Ferenc Bari	28	E	5	5	5	5	5	5	5	5		E3

The total No. of credits for the Publication activity:		**65–81**	

The total No. of credits in Modules 1–4: completion of min. 20, max. 45 credits/semester**;** The total No. of min. 240 credits/8 semesters; max. 360 credits/8 semesters	***min. 233, max. 289**	

The total No. of min. 240 credits/8 semesters (7 credits are required to be collected in optional courses, preferably courses offered by the graduate schools of the MSc, which are included in a separate description)

Compulsory subjects (Semesters 1–4)

1. Biostatistics lecture 28 hours – 6 credits
2. Biostatistics practice 2ó8 hours – 2 credits

i. Total No. of credits in Semester 1: 8 credits

3. Computer-assisted research methodology 28 hours – 6 credits
4. Scientific literature 14 hours – 3 credits
5. Biomedical ethics 14 hours – 3 credits

Total No. of credits in Semester 2: 12 credits

Compulsory subjects related to the PhD subprogram (specialization) (Semesters 1–4)

Regulation measurement and analysis of life processes **(Subprogram 4):**

1. Measurement of life processes (Semester 1 or 3) 28 hours – 6 credits
2. Modern information technologies in medicine (Semester 2 or 4) 28 hours – 6 credits
3. Processing and analysis of measurement data (Semester 2 or 4) 28 hours – 6 credits

Total No. of credits in Semester 4: 18 credits

Elective Subjects (Semesters 1–4)

Exciting trends in Molecular Biology (coordinator: Prof. Sandor BENYHE, Ildiko KARCAGI Institute of Biochemistry, ELKH Biological Research Centre) 28 hour 6 credit spring semester

The training plan consists of 4 parts (modules).

STUDY REQUIREMENTS

General Rules:

- Minimum 20 and maximum 45 credits should be earned in each semester.
- Minimum 90 credits should be earned in Semesters 1–4, and min. 90 credits are required for the admission to the complex examination.
- Students should earn minimum 240 credits during the 8 semesters (2 + 2 years).
- For doing teaching activity, 8 credits can be given per semester, up to a total of 48 credits.
- Research report: 3 credits for each; minimum 1 maximum 4 reports can be rewarded by a total of 12 credits.

Requirements for the complex examination:

The complex examination must be completed at the end of Year 2 (Semester 4).

The sum of all compulsory education credits (basic and subprogram (specialization) credits: 20 + 18 = 38 credits)
Compulsory subjects of the 3 subprograms of the Doctoral School of Theoretical Medicine of the University of Szeged, of which min. 18 credits must be collected in semesters 1–4:

Compulsory subject 1

Details of the course

Subject area:	**PhD**
Course name:	**Measurement of vital signals**
Name of department:	Department of Medical Physics and Informatics
Coordinator:	Prof. Dr. Ferenc Bari
Course requirement:	-
Course announcement (Fall or Spring semester)	Year 1, Fall semester
Suggested course registration:	Semester 1
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-grade system
Maximum number of course registrations:	1
Department announcing the course:	Department of Medical Physics and Informatics
Type of course:	theoretical and practical sessions
Type of examination:	colloquium, written or oral
Lecturers of the course:	-

Topics of the course:	1. Theory of measurement – why, what and how 2. Processing of bio-signals a. signal vs. noise b. sampling c. digitalization 3. Origin of biopotentials, electrodes and design a. modelling b. depolarization of the electrodes c. electrode types for biosignals (macro- and microelectrodes) 4. Amplification and filtering of biosignals a. input resistance b. differential amplifiers 5. Sampling theory and effective noise reduction 6. Investigation of the electrical activity of the heart 7. Electroencephalography 8. Sensors and signal conditioning in bio-signal measurement 9. Types and way of operation of A/D converters 10. Optical measurements a) spectroscopy b) pulseoxymetry 11. Diagnostic ultrasound 12. Blood pressure and blood flow measurements a. factors influencing blood pressure measurement b. direct vs. indirect ways of the measurement c. blood flow and cardiac output 13. Analysis of movements a. devices for analyzing human movements b. applications of movement analysis 14. Analysis of human respiration a. volume, velocity, and pressure b. respiratory mechanics
Required reading:	Herman: Physics of the Human Body

Compulsory subject 2
Details of the course

Subject area:	**Regulation, measurement, and analysis of life processes PhD course**
Course name:	**Modern information technology in medicine**
Name of department:	Department of Medical Physics and Informatics
Coordinator:	Dr. József Tolnai
Course requirement:	There are no prerequisites for the course
Course announcement (Fall or Spring semester)	Spring semester
Suggested course registration:	Spring semester
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-grade system
Maximum number of course registrations:	1
Department announcing the course:	Department of Medical Physics and Informatics
Type of course:	theoretical and practical sessions
Type of examination:	end-semester essay
Lecturers of the course:	Prof. Ferenc Peták Prof. Ferenc Bari Dr. József Tolnai Dr. Attila Nagy Dr. Gergely Fodor
Topics of the course:	The aim of the course is to introduce PhD students to the latest tools for medical applications of information technology. Students will get an insight into the indispensable applications of eHealth, mHealth and telemedicine. Through practical demonstrations, they will learn how to use and develop telemedicine solutions. The course also aims to provide students with a broad base of knowledge in medical imaging. In this context, the course also discusses the medical aspects of 3D design, modelling, and printing by using the 3D printers available at the department. The seminars will also introduce students to the latest information technology solutions, such as using virtual and augmented reality in medicine.
Recommended literature:	Uploaded teaching materials Annotated presentations

Compulsory subject 3
Details of the course

Subject area:	**Regulation, measurement, and analysis of life processes**
Course name:	**Processing and analysis of measurement data**
Name of department:	Department of Medical Physics and Informatics
Coordinator:	Dr Péter Makra
Course requirement:	-
Course announcement (Fall or Spring semester)	Spring semester
Suggested course registration:	Year 1, Semester 2
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	end-semester examination
Maximum number of course registrations:	1
Department announcing the course:	Department of Medical Physics and Informatics
Type of course:	lecture
Type of examination:	written test in CooSpace
Lecturers of the course:	Dr Péter Makra
Topics of the course:	Research in life sciences ever continues to expand the signal analysis toolset it leverages. Whilst it is neither realistic, nor meaningful to expect researchers in this area to know the mathematical rigours of the various signal analysis methods, the efficiency of research and especially of communication between different fields of study greatly benefits if pursuers of life sciences research have a sound user-level knowledge of the signal analysis methods applicable to different problems. The aim of the course is to introduce the area of application, advantages and disadvantages, and potential limitations and pitfalls of the most widespread signal analysis methods, making researchers in life sciences aware of the signal analysis aspects of their research, and thus enabling them to choose the most adequate and efficient method to solve a particular problem.
Recommended literature:	Alan V Oppenheim – Ronald W Schafer: D*iscrete-time signal processing*. Third edition. Pearson, Harlow, 2014. ISBN 10: 1-292-02572-7, ISBN 13: 978-1-292-02572-8 John G Proakis – Dimitris G Manolakis: *Digital signal processing. Fourth edition.* Pearson – Prentice–Hall, Upper Saddle River, New Jersey, 2007. ISBN-13: 9780131873742

	Lawrence R Rabiner – Bernard Gold: *Theory and application of digital signal processing.* Prentice–Hall, Englewood Cliffs, New Jersey, 1975. ISBN-10: 0139141014, ISBN-13: 978-0139141010

PhD training plan in English for students of the Doctoral School at the University of Szeged, Faculty of Medicine

Basic Module 1/subject credit *(min. 38 credits)*

Basic module

Course name	Name of department coordinator	Total number of classes	Requirements	Number of credits in the given semester								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
Computer-assisted research methodology	Department of Medical Physics and Informatics Prof. Dr. Ferenc Peták	28	C	-	6	-	-	-	-	-	-	6	E5
Scientific communication and publication. Methods, rules, and ethics.	Department of Medical Biology Prof. Dr. Ernő Duda	14	C	-	3	-	-	-	-	-	-	3	E5
Biostatistics Lecture	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	6	-	-	-	-	-	-	-	6	E5
Biostatistics Practice	Department of Medical Physics and Informatics Dr. Krisztina Boda	28	C	2	-	-	-	-	-	-	-	2	E3
Biomedical Ethics	Department of Behavioral Sciences Dr. Oguz Kelemen	14	C	-	3	-	-	-	-	-	-	3	E5
Total No. of credits in Basic Module 1				**8**	**12**	**-**	**-**	**-**	**-**	**-**	**-**	**20**	

1 C (Compulsory subject)
2 E (Elective subject)
3 CE (Compulsory elective subject)

Details of the course

	Basic module
Subject area:	PhD day-training for SH students and self-cost students
Course name:	**Computer-assisted research methodology**
Name of department:	Department of Medical Physics and Informatics, Faculty of Medicine, University of Szeged
Coordinator:	Prof. Dr. Ferenc Peták
Course requirement:	-
Course announcement (Fall or Spring semester)	Semester 2 (Spring semester)
Suggested course registration:	Year 1 or 2 of the curriculum
Number of classes weekly:	2
Total number of classes:	28
No. of credits:	6
Form of evaluation:	5-grade system practical examination
Maximum number of course registrations:	2
Department announcing the course:	Department of Medical Physics and Informatics, Faculty of Medicine, University of Szeged
Type of course:	practice
Type of examination:	written
Lecturers of the course:	Prof. Dr. Ferenc Peták, Dr. József Tolnai
Topics of the course:	Basic concepts of data collection and analyses in life sciences (2 lessons) Data processing in life sciences. Preprocessing, data evaluation, sorting and filtering, data manipulation functions, database processing, and the pivot table (10 lessons) Reporting scientific data, scientific graphing, and the use of scientific graphing software (4 lessons) Online scientific databases. Computer systems for manuscript submission, the review and the editorial processes. Introduction to scientometry (2 lessons) Presentation of scientific data. Structure and content: their unity to express the message (4 lessons) Handout, manuscript, and theses preparations. Formal requirements, design styles, structure,

	and content. Introduction to complex, advanced document editing: styles, tables, insertion of images to the text, charts, equations and mathematical formulas. Reference management (6 lessons)
Recommended literature:	- Handouts and syllabus provided at the practical sessions

Informing students on course requirements

(In accordance with the information and study materials available on CooSpace)

From February 2019

Program: PhD day-training for SH students and self-cost students
Course: **Scientific communication and publication. Methods, rules, and ethics.**
Academic year/Semester: **2019/2020, 2**
Educator and contact details (e-mail): **Prof. Ernő Duda duda@brc.hu**
Type of course: **lecture/**seminar/practice/laboratory Lectures Examination date: **17 April 2020.**
Weekly hours of the course: **1** (14 hours)
Credit vale of the course: **3**
Type of examination**:** final examination at the end of the semester, practice examination, other: final written (multiple choice) examination at the end of the semester
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): **none** (be a PhD student)
Purpose of course: To help students navigate in the (natural) sciences of the 21st century. Planning, execution, and documentation of experiments. Reproducibility, significance of results. Ways and tools of scientific communication. Posters, oral presentations, publications, PhD theses, chapters, books, and patents. Open science, open access, blockchain in science. Peer review, predatory journals, and the impact of publications.
Outcome requirements of the course (specific academic results to be established by the course): The students should know how to plan and evaluate experiments, how to tell if the results are reproducible, how to document their results, how to communicate their

research, how to write a scientific paper, a PhD thesis, when to contact a legal expert to file patents.
They should know where to look for information concerning legal requirements, financial regulations, how to participate in (international) cooperations, how to form consortia, where to find scientific courses, calls for scientific proposals, and how and when to use AI.

Topics:

Data mining
Big data – structured and unstructured big data
Extract data from websites, applications, spreadsheets, IT infrastructure, emails and more
Interpret diverse file naming conversions
Check data for completeness and accuracy
Transform unstructured data automatically into easily digestible reports, tables, or files
Move data and files securely to different locations and users with file transfer automation

AI
Artificial intelligence in medical diagnosis
Artificial Intelligence in Medical Epidemiology
AI in medical (pharmaceutical) research and discovery
Informed, strategic decision making
Natural Language Processing
Machine learning
Deep structured or ”hierarchical” learning

Meta-analysis
Purpose of the research
Working plan, hypothesis
Sample collection, data base
Analysis, validation
Comparison with reference data
Results, publication

Science in the 21st century
Civilisation, religion, empirical science
Ancient science, medieval science, development of experimental sciences
Industrial revolution, modern science, trends in the 20th and 21st centuries
Forms and rules of scientific communication
Scientific literature, databases, impact, and citations

Scientific career
Phases of the scientific career
Requirements of success in different phases
World science, collaborations, and networks
Your proposals, your project, and your own team
Know your skills and talents!
Different paths after PhD

Challenges in the 21st century Irreproducible research: mistakes, fabrications, and plagiarism Plagiarism-detecting software, corrections, and retractions Digital age: OCRID, scientist with a number, contribution to a publication Open access: price, importance, advantages and complications, publication of negative results Open access journals, predator journals Electronic notebooks, patents or blockchain? Death of IF
Supporting methods to achieve learning outcomes: Convincing lectures
Evaluation of the acquisition of expected learning outcomes: Evaluation will be in accordance with the purposes and requirements of the course: written examination at the end of the lectures.
Mandatory reading list: none
Recommended reading list: none

Indicating course requirements on CooSpace scene (summary)

Description (public): The course deals with communication and publication of results of experimental sciences. From planning the experiment to the publication of results and discoveries. Forms, means, and ways of correct scientific communication will be discussed.
Requirements: Be familiar with all rules, regulations, tools, and techniques of scientific communication, and know about the challenges of current times.
Topics: Big data, data bases, data mining, IT infrastructure Artificial intelligence in diagnosis, research and discovery Machine learning, ”hierarchical” learning Meta-analysis Forms and rules of scientific communication Scientific career World science, collaborations, networks Publications, success, and challenges in the 21st century

Informing students on course requirements

(In accordance with the information and study materials available on CooSpace)

From September 2019

Program: PhD day-training for SH students and self-cost students
Course: **Biostatistics lecture**
Academic year/Semester: 2019/20 Semester 1
Educator and contact details (e-mail): Stéhlik Jánosné Dr. Krisztina Boda boda.krisztina@med.u-szeged.hu Dr. Tibor Nyári nyari.tibor@med.u-szeged.hu Mónika Szűcs szucs.monika@med.u-szeged.hu
Type of course: lecture/seminar/practice/laboratory
Weekly hours of the course: 2
Credit vale of the course: 6
Type of examination: final examination at the end of the semester, practice exam, other:……..
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course):
Purpose of course: The aim of the course is to provide basic practical knowledge of biostatistics, the use and interpretation of the most frequently used basic biostatistical methods used in medical research with the use of a statistical software. With conceptual understanding of data and data collection, we introduce techniques of data processing, representation, and interpretation. We cover topics of trend analysis, use of hypotheses, frequently used statistical tests and their applications. Students will be able to state hypotheses according to the given experimental design, formulate the data base, characterize the distribution of variables according to their type. Students will be familiar with the methods of the most frequently used hypothesis tests, they will be able to find the appropriate methods to test their hypotheses, and interpret the results of computer programs and/or scientific papers.
Topics: 1. **Data description. Types of data, displaying data. Sample characteristics.** (categorical and continuous variables, absolute and relative frequency, bar chart, pie chart, histogram; mean, median, mode, range, quartiles, variance, standard deviation, mean-error chart, and box diagram) 2. **The basics of probability theory.** The concept of probability, rules of probability calculus. Diagnostic tests and conditional probabilities.

3. **Population, statistical sample.** The distribution of categorical and continuous variables, and the density function. Density function, the normal distribution. Statistical estimation, confidence interval. The standard error of mean. The use of Student's t-table
4. **Statistical inference, t-tests** (one sample, paired and independent samples t-test)**.** Significance test by confidence interval, t-statistics, or p-value.
5. **Analysis of variance** (principle of one-way ANOVA, F-test, and pairwise comparisons).
6. **The basics of sample size calculation**. Type I and II errors, statistical power.
7. **Correlation–regression analysis**
8. **The chi-squared test for independence** (assumptions, Fisher exact test)
9. **Nonparametric methods based on ranks** (Wilcoxon test, Mann–Whitney test, Kruskal–Wallis test)
10. **2x2 tables in epidemiology** (Cohen-Kappa, relative risk, and odds ratio), logistic regression
11. **Survival analysis**
12. **The basics of multivariate methods.**

Supporting methods to achieve learning outcomes:

Teaching methods:
Besides giving a theoretical background, we give practical examples based on medical, biological research papers to show the application of the methods in practice. During some lectures, students actually present on the lectures and do home assignments to get bonus points on the final examination.

Evaluation of the acquisition of expected learning outcomes:

Requirements:
Attendance of the lectures is strongly recommended; downloading the lecture slides cannot substitute for the participation at the lecture. The course ends in an end-semester examination.
The lectures are complemented by a practical course the aim of which is to help students reach a deeper understanding of the lecture material.
Examination requirements

- Students failing to meet the requirements of the course cannot take the examination.

The end-semester examination:

- Theoretical part. Students will get a list of topics about the theory and some typical manual calculations. The final examination is a written examination where students will get one topic and some manual calculation problems. Maximum 100 points can be reached on the theoretical part.
- No statistical software will be used on the examination. Students have to sign up for the examination through the Neptun system. Repetition of

examinations is according to the general regulations of the Study and the Examination Requirements of the University.

- Practical part: during the practical lessons students may get maximum 100 points based on the two written tests.
- The examination mark consists of two parts: practical part (max. 100 p) + examination part (max. 100 p).
- Core topics: not knowing whether a difference is statistically significant or not on a given level will cause failing the examination (independently of the other knowledge)
- The examination mark is the sum of the points of the theory and practice

Accomplishment, theory+practice, %	Evaluation
0 –50%	failed (1)
51–62.5%	passed (2)
63–75%	accepted (3)
76–87.5%	good (4)
88–100%	excellent (5)

Mandatory reading list:

Students can download course materials (handouts, lecture notes, and R scripts) from the Coospace. Taking notes at the lectures will help in preparing for the examination.

Recommended reading list:

- Michael J. Campbell – David Machin – Stephen J. Walters: Medical Statistics. A Textbook for the Health Sciences (2012) ISBN: 978-1-118-30061-9
- Internet resources:
  Khan Academy: https://www.khanacademy.org/math/statistics-probability
  Crash Course (Statistics):
  https://www.youtube.com/playlist?list=PL8dPuuaLjXtNM_Y-bUAhblSAdWRnmBUcr
  Rice Virtual Lab in Statistics: http://onlinestatbook.com/rvls.html
- Reiczigel Jenő – Harnos Andrea – Solymosi Norbert: Biostatisztika nem statisztikusoknak (2014). Pars Kft. ISBN: 978-963-06-3736-7 (In Hungarian)
- E-learning (in Hungarian): http://eta.bibl.u-szeged.hu/view/creators/Sz==0171cs=3AM=F3nika=3A=3A.html

Indicating course requirements on CooSpace scene (summary)

Description (public):

The aim of the course is to provide basic practical knowledge of biostatistics, the use and interpretation of the most frequently used basic biostatistical methods used in medical research with the use of a statistical software. With conceptual understanding of data and data collection, we introduce techniques of data processing, representation, and interpretation. We cover topics of trend analysis, use of hypotheses, frequently used statistical tests and their applications. Students will be able to state hypotheses according to the given experimental design, formulate the data base, characterize the distribution of variables according to their type. Students will be familiar with the methods of the most frequently used hypothesis tests, they will be able to find the appropriate methods to test their hypotheses, and interpret the results of computer programs and/or scientific papers.

Evaluation of the acquisition of expected learning outcomes:

Requirements:
Attendance of the lectures is strongly recommended; downloading the lecture slides cannot substitute for the participation at the lecture. The course ends in an end-semester examination.
The lectures are complemented by a practical course the aim of which is to help students reach a deeper understanding of the lecture material.
Examination requirements

- Students failing to meet the requirements of the course cannot take the examination.

The end-semester examination:

- Theoretical part. Students will get a list of topics about the theory and some typical manual calculations. The final examination is a written examination where students will get one topic and some manual calculation problems. Maximum 100 points can be reached on the theoretical part.
- No statistical software will be used on the examination. Students have to sign up for the examination through the Neptun system. Repetition of examinations is according to the general regulations of the Study and the Examination Requirements of the University.
- Practical part: during the practical lessons students may get maximum 100 points based on the two written tests.
- The examination mark consists of two parts: practical part (max. 100 p) + examination part (max. 100 p).
- Core topics: not knowing whether a difference is statistically significant or not on a given level will cause failing the examination (independently of the other knowledge)
- The examination mark is the sum of the points of the theory and practice

Accomplishment, theory+practice, %	Evaluation
0 –50%	failed (1)

51–62.5%	passed (2)
63–75%	accepted (3)
76–87.5%	good (4)
88–100%	excellent (5)

Topics:

1. **Data description. Types of data, displaying data. Sample characteristics.** (categorical and continuous variables, absolute and relative frequency, bar chart, pie chart, histogram; mean, median, mode, range, quartiles, variance, standard deviation, mean-error chart, and box diagram)
2. **The basics of probability theory.** The concept of probability, rules of probability calculus. Diagnostic tests and conditional probabilities.
3. **Population, statistical sample.** The distribution of categorical and continuous variables, and the density function. Density function, the normal distribution. Statistical estimation, confidence interval. The standard error of mean. The use of Student's t-table
4. **Statistical inference, t-tests** (one sample, paired and independent samples t-test)**.** Significance test by confidence interval, t-statistics, or p-value.
5. **Analysis of variance** (principle of one-way ANOVA, F-test, and pairwise comparisons).
6. **The basics of sample size calculation**. Type I and II errors, statistical power.
7. **Correlation–regression analysis**
8. **The chi-squared test for independence** (assumptions, Fisher exact test)
9. **Nonparametric methods based on ranks** (Wilcoxon test, Mann–Whitney test, Kruskal–Wallis test)
10. **2x2 tables in epidemiology** (Cohen-Kappa, relative risk, and odds ratio), logistic regression
11. **Survival analysis**
12. **The basics of multivariate methods.**

Course description template

Informing students on course requirements

(In accordance with the information and study materials available on CooSpace)

From September 2019

Program: PhD day-training for SH students and self-cost students
Course**: Biostatistics practice**
Academic year/Semester: 2019/20 Semester 1
Educator and contact details (e-mail): Stéhlik Jánosné Dr. Krisztina Boda boda.krisztina@med.u-szeged.hu Dr. Tibor Nyári nyari.tibor@med.u-szeged.hu Mónika Szűcs szucs.monika@med.u-szeged.hu
Type of course: lecture/seminar/practice/laboratory
Weekly hours of the course: **2**
Credit vale of the course: **2**
Type of examination: final examination at the end of semester, practice examination, other: **three-level acceptance**
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): not
Purpose of course: The aim of the course is to provide basic practical knowledge of biostatistics, the use and interpretation of the most frequently used basic biostatistical methods used in medical research with the use of a statistical software. With conceptual understanding of data and data collection, we introduce techniques of data processing, representation, and interpretation. We cover topics of trend analysis, use of hypotheses, frequently used statistical tests and their applications. Students will be able to state hypotheses according to the given experimental design, formulate the data base, characterize the distribution of variables according to their type. Students will be familiar with the methods of the most frequently used hypothesis tests, they will be able to find the appropriate methods to test their hypotheses, and interpret the results of computer programs and/or scientific papers.
Topics: 1. **Data description. Types of data, displaying data. Sample characteristics.** (categorical and continuous variables, absolute and relative frequency, bar chart, pie chart, histogram; mean, median, mode, range, quartiles, variance, standard deviation, mean-error chart, and box diagram) 2. **The basics of probability theory.** The concept of probability, rules of probability calculus. Diagnostic tests and conditional probabilities. 3. **Population, statistical sample.** The distribution of categorical and continuous variables, and the density function. Density function, the normal distribution. Statistical estimation, confidence interval. The standard error of mean. The use of Student's t-table

4. **Statistical inference, t-tests** (one sample, paired and independent samples t-test)**.** Significance test by confidence interval, t-statistics, or p-value.
5. **Analysis of variance** (principle of one-way ANOVA, F-test, and pairwise comparisons).
6. **The basics of sample size calculation**. Type I and II errors, statistical power.
7. **Correlation–regression analysis**
8. **The chi-squared test for independence** (assumptions, Fisher exact test)
9. **Nonparametric methods based on ranks** (Wilcoxon test, Mann–Whitney test, Kruskal–Wallis test)
10. **2x2 tables in epidemiology** (Cohen-Kappa, relative risk, and odds ratio), logistic regression
11. **Survival analysis**
12. **The basics of multivariate methods.**

Supporting methods to achieve learning outcomes:

Teaching methods:

Evaluation of the acquisition of expected learning outcomes:

Requirements:
Attendance of the practical is compulsory. Participating in the practical sessions in accordance with the "Study Guide of the Faculty of Medicine". Maximum 3 absences are allowed and at least 50% accomplishment of the course (see below). Students who arrive more than 15 minutes late will be considered absent.
Forms of testing
The students have to perform two tests containing practical problems to be solved by hand calculations and by a computer program (R). During the tests, the use of calculators, computers (without Internet), and own notes on a single A4 sheet are permitted.
Evaluation of the course:
The result of the course is evaluated by a three-grade system. It will be calculated from the points of the tests (maximum 100 points). For a successful accomplishment of the course, the total accomplishment must be at least 50%.
Make-up possibilities:
Make-up tests are possible on the last week. Both tests have to be repeated – except, when one of the tests is above 75%, then only the test with the lower points has to be repeated. In any case, the points of the make-up will be used in the calculation of the final mark.

- Evaluation of the practical is based on the sum of two tests

Accomplishment, practice, %	Evaluation
0 –50%	not met requirements (NOMETRE)
51–90%	met requirements /Passed (METRE/P)t

90%–	met requirements /High mark (METRE/H)

Mandatory reading list:
Students can download course material (handouts, lecture notes, and R scripts) from the Coospace. Taking notes at the lectures will help in preparing for the examination.

Recommended reading list:

- Michael J. Campbell – David Machin – Stephen J. Walters: Medical Statistics. A Textbook for the Health Sciences (2012) ISBN: 978-1-118-30061-9
- Internet resources:
  Khan Academy: https://www.khanacademy.org/math/statistics-probability
  Crash Course (Statistics):
  https://www.youtube.com/playlist?list=PL8dPuuaLjXtNM_Y-bUAhblSAdWRnmBUcr
  Rice Virtual Lab in Statistics: http://onlinestatbook.com/rvls.html
- Reiczigel Jenő – Harnos Andrea – Solymosi Norbert: Biostatisztika nem statisztikusoknak (2014). Pars Kft. ISBN: 978-963-06-3736-7 (In Hungarian)
- E-learning (in Hungarian): http://eta.bibl.u-szeged.hu/view/creators/Sz==0171cs=3AM=F3nika=3A=3A.html

Indicating course requirements on CooSpace scene (summary)

Description (public):

The aim of the course is to provide basic practical knowledge of biostatistics, the use and interpretation of the most frequently used basic biostatistical methods used in medical research with the use of a statistical software. With conceptual understanding of data and data collection, we introduce techniques of data processing, representation, and interpretation. We cover topics of trend analysis, use of hypotheses, frequently used statistical tests and their applications. Students will be able to state hypotheses according to the given experimental design, formulate the data base, characterize the distribution of variables according to their type. Students will be familiar with the methods of the most frequently used hypothesis tests, they will be able to find the appropriate methods to test their hypotheses, and interpret the results of computer programs and/or scientific papers.

Evaluation of the acquisition of expected learning outcomes:

Requirements:

Attendance of the practical is compulsory. Participating in the practical sessions in accordance with the “Study Guide of the Faculty of Medicine”. Maximum 3 absences are allowed and at least 50% accomplishment of the course (see below). Students who arrive more than 15 minutes late will be considered absent.

Forms of testing

The students have to perform two tests containing practical problems to be solved by hand calculations and by a computer program (R). During the tests, the use of calculators, computers (without Internet), and own notes on a single A4 sheet are permitted.

Evaluation of the course:

The result of the course is evaluated by a three-grade system. It will be calculated from the points of the tests (maximum 100 points). For a successful accomplishment of the course, the total accomplishment must be at least 50%.

Make-up possibilities:

Make-up tests are possible on the last week. Both tests have to be repeated – except, when one of the tests is above 75%, then only the test with the lower points has to be repeated. In any case, the points of the make-up will be used in the calculation of the final mark.

- Evaluation of the practical is based on the sum of two tests

Accomplishment, practice, %	Evaluation
0 –50%	not met requirements (NOMETRE)
51–90%	met requirements /Passed (METRE/P)t
90%–	met requirements /High mark (METRE/H)

Topics:

1. **Data description. Types of data, displaying data. Sample characteristics.** (categorical and continuous variables, absolute and relative frequency, bar chart, pie chart, histogram; mean, median, mode, range, quartiles, variance, standard deviation, mean-error chart, and box diagram)
2. **The basics of probability theory.** The concept of probability, rules of probability calculus. Diagnostic tests and conditional probabilities.
3. **Population, statistical sample.** The distribution of categorical and continuous variables, and the density function. Density function, the normal distribution. Statistical estimation, confidence interval. The standard error of mean. The use of Student’s t-table
4. **Statistical inference, t-tests** (one sample, paired and independent samples t-test)**.** Significance test by confidence interval, t-statistics, or p-value.
5. **Analysis of variance** (principle of one-way ANOVA, F-test, and pairwise comparisons).
6. **The basics of sample size calculation**. Type I and II errors, statistical power.
7. **Correlation–regression analysis**
8. **The chi-squared test for independence** (assumptions, Fisher exact test)

9. **Nonparametric methods based on ranks** (Wilcoxon test, Mann–Whitney test, Kruskal–Wallis test)
10. **2x2 tables in epidemiology** (Cohen-Kappa, relative risk, and odds ratio), logistic regression
11. **Survival analysis**
12. **The basics of multivariate methods.**

Course description template

Informing students on the course requirements

(In accordance with the information and study materials available on CooSpace)

From February 2020

Program: PhD day-training for SH students and self-cost students
Course: **Biomedical ethics**
Academic year/Semester: 2019/2020 Semester 2
Educator and contact details (e-mail): Gergely Tari, tari.gergely.robert@med.u-szeged.hu
Type of course: lecture/seminar**/practice**/laboratory
Weekly hours of the course: 7*2 hours
Credit value of the course: 3 credits
Type of examination: final examination at the end of semester, **practice examination**, other:……..
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): **not**
Purpose of course: Bioethics is a rapidly developing field of applied ethics, strongly related to biomedical research. However, advanced medical technologies armor medical professionals with all new diagnostic and curative tools, ethical and legal reflection is often necessary before using them routinely in the daily medical practice. The aim of the course is to present all the bioethical principles (patient autonomy, non-maleficence, beneficence, and justice) to our students as well the international laws that are regulating biomedical research. The course is recommended to all who are somehow involved in scientific research.
Outcome requirements of the course (specific academic results to be established by the course):

Knowledge

- Being familiar with the basic bioethical principles
- Being familiar with the history of ethics of animal research
- Being familiar with the history of ethics of human subject research
- Being familiar with the most important international ethical guidelines regulating the practice of medical professionals and biomedical researchers

Competences

- Having the skill to use appropriate arguments based on sound ethical standards
- Having the skill to recognize ethical dilemmas in the clinical practice
- Having the skills to apply basic bioethical principles to solve moral dilemmas

Attitudes

- Sensitizing our students to favor an attitude in which the most influential norms are patient autonomy, human dignity, and non-discrimination.

Autonomy and responsibility

- Having responsibility to behave according to the standards of modern biomedical ethics and be able to recognize, interpret, and if it is possible, solve ethical dilemmas.

Topics:

1. Introduction to bioethics
2. Basics of human subject research – international ethical and legal approaches
3. Basics of animal experimentation – international ethical and legal approaches
4. Ethical implications regarding human subject research
5. Ethical issues of human reproduction (in vivo and in vitro fertilization)
6. ”Gene-ethics” (CRISPR-Cas9)
7. Practical application of ethical principles of biomedical research (workshop)

Supporting methods to achieve learning outcomes:

Workshops
Practicing moral arguments

Evaluation of the acquisition of expected learning outcomes:

- Attandence is regulated according to the study and examination rules
- The grade is given according to attendance
- A written test should be taken by students who have abscences

Mandatory reading list: Dr. Kovács József: A modern orvosi etika alapjai. Medicina, Budapest, 2006.
Recommended reading list: Sinaci, M., Sorgner, S.F. (szerk.): Ethics of Emerging Biotechnologies. From Educating the Young to Engineering Posthumans. Trivent Publishing, Budapest, 2018.

Indicating course requirements on CooSpace scene (summary)

Description (public): Bioethics is a rapidly developing field of applied ethics, strongly related to biomedical research. However, advanced medical technologies armor medical professionals with all new diagnostic and curative tools, ethical and legal reflection is often necessary before using them routinely in the daily medical practice. The aim of the course is to present all the bioethical principles (patient autonomy, non-maleficence, beneficence, and justice) to our students as well the international laws that are regulating biomedical research. The course is recommended to all who are somehow involved in scientific research.
Requirements: Knowledge - Being familiar with the basic bioethical principles - Being familiar with the history of ethics of animal research - Being familiar with the history of ethics of human subject research - Being familiar with the most important international ethical guidelines regulating the practice of medical professionals and biomedical researchers Competences - Having the skill to use appropriate arguments based on sound ethical standards - Having the skill to recognize ethical dilemmas in the clinical practice - Having the skills to apply basic bioethical principles to solve moral dilemmas Attitudes

- Sensitizing our students to favor an attitude in which the most influential norms are patient autonomy, human dignity and non-discrimination.

Autonomy and responsibility

- Having responsibility to behave according to the standards of modern biomedical ethics and be able to recognize, interpret and if it is possible solve ethical dilemmas

Evaluation of the acquisition of expected learning outcomes:

- Attandence regulated according to the study and examination rules
- Grade is given according to attendance
- Written test should be written for those students who have abscences

Topics:

1. Introduction to bioethics
2. Basics of human subject research – international ethical and legal approaches
3. Basics of animal experimentation – international ethical and legal approaches
4. Ethical implications regarding human subject research
5. Ethical issues of human reproduction (in vivo and in vitro fertilization)
6. ”Gene-ethics” (CRISPR-Cas9)
7. Practical application of ethical principles of biomedical research (workshop)

Supporting methods to achieve learning outcomes:

Workshops
Practicing moral arguments

Mandatory reading list:

Dr. Kovács József: A modern orvosi etika alapjai. Medicina, Budapest, 2006.

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SUBJECTS IN THE BASIC MODULE ARE THE SAME IN THE SUBPROGRAM OF EACH DOCTORAL SCHOOL.

ELECTIVE SUBJECT

Subject area:	Molecular biology, biochemistry, systems biology
Course name:	**Exciting trends in Molecular Biology**
Name of department:	Institute of Biochemistry, ELKH Biological Research Centre
Coordinator:	Sandor BENYHE, Ildiko KARCAGI
Course requirement:	MSc level is expected
Course announcement (Fall or Spring semester)	Spring semester
Suggested course registration:	The course is recommended for PhD students.
Number of classes weekly:	2
Total number of classes:	28
Credits:	6
Evaluation:	Regular participation is expected. The lecturer students themselves choose the article to be presented.
Maximal number of course registrations:	35
Course announcing department:	Institute of Biochemistry, ELKH Biological Research Centre
Type of course:	Scientific Journal Club; Participating students present the research findings of an elective scientific article. It is recommended to summarize a publication that contains important or interesting work belonging to the main line of molecular biology.
Type of exam:	Regular participation is a condition for completing the credit. Students also discuss and evaluate each other's lectures during the course.
Lecturers of the course:	The students themselves give presentations, typically 2-2 lectures at a time. PPT presentation is recommended.
Time	Weekly, 09:00 AM on every Tuesdays
Place	Presently online (zoom meetings)
Topics of the course:	Molecular biology, biochemistry, systems biology
Required reading:	Based on individual choice of students