

DOCTORAL SCHOOL OF MULTIDISCIPLINARY MEDICAL SCIENCES
TRAINING PLAN
SEPTEMBER 1, 2024.

Director: **Prof. Norbert Jost, habil, PhD, DSc**
Full Professor
Department of Pharmacology and Pharmacotherapy,
Albert Szent-Györgyi Medical School, University of Szeged
H-6720 Szeged, Dóm tér 12, Hungary
Tel.: +36 62 546-885, Fax: +36-62-545-680
e-mail: jost.norbert@med.u-szeged.hu

Associate Director: **Prof. Mária Dux, habil, MD, PhD, DSc**
Full Professor
Department of Physiology, Albert Szent-Györgyi
Medical School, University of Szeged
H-6720 Szeged, Dóm tér 10, Hungary
Tel.: +36 62 545-374
e-mail: dux.maria@med.u-szeged.hu

Administrator: **Tünde Bodnár MSc**
Department of Biochemistry, Faculty of Medicine,
University of Szeged
H-6720 Szeged, Dóm tér 9, Hungary
Tel.: +36 62 545-096, Fax: +36 62 545-097
E-mail: bodnar.tunde@med.u-szeged.hu

CO-OPERATING INSTITUTIONS

Faculty of Medicine, University of Szeged:

Department of Biochemistry
Department of Pharmacology and Pharmacotherapy
1st Department of Internal Medicine
2nd Department of Internal Medicine

Department of Medical Biology
Department of Medical Informatics
Institute of Surgical Research
Department of Anesthesiology and Intensive Therapy

Biological Research Centre, Szeged:

Institute of Biophysics
Institute of Biochemistry
Institute of Genetics
Central Laboratories – Laboratory of Functional Genomics

Institute of Enzymology of the Research Centre for Natural Sciences, Budapest

DOCTORAL TRAINING PROGRAMMES

I. PHYSIOLOGY, PATHOPHYSIOLOGY, AND PHARMACOLOGY OF THE CARDIOVASCULAR SYSTEM

Programme director: **Prof. Norbert Jost habil, PhD, DSc**

Department of Pharmacology and Pharmacotherapy,
Albert Szent-Györgyi Medical School, University of Szeged
H-6720 Szeged, Dóm tér 12, Hungary
Tel: +36-62-546-885 Fax: +36-62-545-680
E-mail: jost.norbert@med.u-szeged.hu

Physiology, Pathophysiology, and Pharmacology of the Cardiovascular System

I/1. Experimental Cardiology and Cardiovascular Pharmacology

Coordinator: **Prof. Norbert Jost habil, PhD, DSc**
Department of Pharmacology and Pharmacotherapy,
Albert Szent-Györgyi Medical School, University of Szeged
H-6720 Szeged, Dóm tér 12, Hungary
Tel: +36-62-546-885 Fax: +36-62-545-680
E-mail: jost.norbert@med.u-szeged.hu

I/2. Experimental Study of Clinically Significant Cardiorespiratory Pathomechanisms

Coordinator: Prof. Mihály Boros MD, PhD, DSc
Institute of Surgical Research,
Albert Szent-Györgyi Medical School, University of Szeged
H-6720 Szeged, Szőkefalvi-Nagy Béla u. 6, Hungary
Tel: +36-62-545-103, Fax: +36-62-545-743
E-mail: boros.mihaly@med.u-szeged.hu

II. BIOCHEMISTRY, BIOPHYSICS, MOLECULAR AND CELL BIOLOGY

Programme director: **Prof. Dr. Mária Dux MD, PhD, DSc**

Department of Physiology,
Albert Szent-Györgyi Medical School, University of Szeged
H-6720, Szeged, Dóm tér 10, Hungary
Tel: +36-62-545-374
E-mail: dux.maria@med.u-szeged.hu

STUDY REQUIREMENTS – PHD TRAINING PLAN: (CREDIT PLAN)

Duration of the PhD programme: 4 + 4 semesters

Credits: min. 240 credits / 8 semesters have to be earned by a student of this programme during the doctoral studies

MODULES (SEMESTERS 1–4 OF PHD STUDIES):

Module 1 (Semesters 1–4 of PhD studies): Basic and Major compulsory PhD courses

1a Major (compulsory) PhD courses

1b Major / Special (PhD programme related) compulsory PhD courses

Module 2 (Semesters 1–4 of PhD studies): Research activities (compulsory)

Module 3 (Semesters 1–8 of PhD studies): Educational activities (optional)

Module 4: Publication activities (compulsory, not related to semesters)

MODULES (SEMESTERS 1–4 OF PHD STUDIES):

MODULE 1A: BASIC (COMPULSORY) PHD COURSES

(Semesters 1–4 of PhD studies, 20 credits):

1. semester:

1. Biostatistics Lecture (28 hours) – 6 credits

2. Biostatistics Practice (20 hours) – 2 credits

Head of the course: Dr. Krisztina Boda PhD

Lecturers: Krisztina Boda PhD, Tibor Nyári PhD, Szűcs Mónika,

Department of Medical Physics and Informatics

Faculty of Medicine, Faculty of Science and Informatics, University of Szeged

H-6720 Szeged, Korányi fasor 9, Hungary,

Tel/Fax: +36-62-544-566, e-mail: office.dmi@med.u-szeged.hu

2. semester

3. Computer-assisted research methodology (28 hours) – 6 credits

Head of the course: Prof. Dr. Ferenc Peták PhD, DSc

Department of Medical Physics and Informatics

Faculty of Medicine, Faculty of Science and Informatics, University of Szeged

H-6720 Szeged, Korányi fasor 9, Hungary

Tel/Fax: +36-62-544-566, e-mail: office.dmi@med.u-szeged.hu

4. Biomedical Ethics (14 hours) – Tbd (in one Block) – 3 credits

Head of the course: Dr. habil. Oguz Kelemen MD, PhD

Department of Behavioral Sciences, Faculty of Medicine, University of Szeged

H-6722 Szeged, Szentháromság u. 5, Hungary

Tel: +36-62-420-530, fax: 62/420-530; 545-968

e-mail: kelemen.oguz@med.u-szeged.hu

5. Scientific literature (14 hours) -- Tbd (in one Block) – 3 credits

Head of the course: Prof. Dr. Ernő Duda PhD, DSc

Department of Medical Biology, Faculty of Medicine, University of Szeged

H-6720 Szeged, Somogyi u. 4, Hungary

Tel: +36-62- 545-592

e-mail: duda.erno@med.u-szeged.hu

COMPLEX EXAMINATION: at the end of Semester 4

MODULE 1B: MAJOR COMPULSORY PHD COURSES

(Semesters 1–4 of PhD studies, 18 credits):

Semester 2.

1. Advanced Biochemistry, Biophysics, Molecular Cell Biology, and Pharmacology I.

(Biochemistry and Cardiac Electrophysiology and the mechanism of the arrhythmias)

Course type: Lecture

14 x 3 classes per week, 42 hours per semester, 9 credits

Head of the course: Prof. Dr. László Dux MD, PhD, DSc, Department of Biochemistry, Faculty of Medicine, University of Szeged, email: dux.laszlo@med.u-szeged.hu

Prof. András Varró MD, PhD, DSc - Department of Pharmacology and Pharmacotherapy, Faculty of Medicine, University of Szeged, email: varro.andras@med.u-szeged.hu

Biochemistry

Supervisor: Prof Dr. László Dux

1. Membranes I.

Lecturer: Prof. Dr. László Dux DSc,

Department of Biochemistry

e-mail: laszlo.dux@med.u-szeged.hu

2. Crystallization of membrane proteins

Lecturer: Dr. habil. Gerda Szakonyi PhD

Faculty of Pharmacy, Institute of Pharmaceutical Analysis

e-mail: gerda.szakonyi@pharm.u-szeged.hu

3. Membranes II.

Lecturer: Prof. Dr. László Dux DSc,

Department of Biochemistry

e-mail: laszlo.dux@med.u-szeged.hu

4. Non-coding RNAs

Lecturer: Dr. habil. Márta Sárközy PhD

Department of Department of Pathophysiology

e-mail: marta.sarkozy@med.u-szeged.hu

5. Molecular mechanisms of cardiac fibrosis and hypertrophy

Lecturer: Dr. habil. Márta Sárközy MD PhD

Department of Pathophysiology

e-mail: sarkozy.marta@med.u-szeged.hu

6. Molecular Signalling I.

Lecturer: Dr. Anikó Keller-Pintér PhD

Department of Biochemistry

e-mail: keller.aniko@med.u-szeged.hu

7. Molecular Signalling II.

Lecturer: Dr. Anikó Keller-Pintér PhD

Cardiac Electrophysiology and the mechanism of the arrhythmias PhD course

Supervisors: Prof Dr. András Varró and Dr. Norbert Jost

1. Basic principles of electrophysiology, the impulse propagation in the heart

Lecturer: Dr. Norbert Nagy

Transmembrane transport, Donnan equilibrium, resting potential,
Nernst equation, ion channels, Local and action potentials

2. The action potential and the underlying ionic currents

Lecturer: Dr. Norbert Jost

Depolarization and repolarization activated currents, refractoriness
Relation between the action potential and the ECG
Action potential and currents
 Na^+ , K^+ and Ca^{2+} currents
Other currents

3. Excitation-contraction coupling in cardiomyocytes

Lecturer: Dr. Norbert Nagy

Major cellular structures involved in E-C coupling
Cardiac action potentials and ion channels
Na/Ca exchange and the sarcolemmal Ca-pump
Control of cardiac contraction by SR and SL Ca fluxes
Cardiac inotropy, Ca „mismanagement”

4. Investigational techniques in cardiac electrophysiology

Lecturer: Dr. Norbert Jost

Action potential measurements
Patch-clamp technique
Isolated heart technique

5. The mechanism of the cardiac arrhythmias

Lecturers: Prof András Varró and Dr. Norbert Jost

Normal activity
Disorder of the automaticity (EADs and DAD)s
Re-entry arrhythmias, AV nodal re-entry
The arrhythmogenic mechanism of the repolarization inhomogeneity

6. Genetic background of ion-channel disturbances in the heart

Lecturer: Dr. Norbert Nagy

The classification of human genetic diseases
The molecular structure of the cardiac ion channels
Hereditary ion channel diseases

7. Sudden cardiac death and exercise-induced cardiovascular adaptation

Lecturer: Dr. Attila Farkas

Effects of regular physical exercise
Effects of endurance training - remodelling, the athlete's heart
Sudden cardiac death in athletes

Each course is 3 hours lecture (3 x 45 minutes block)

Each course is supposed to a topic at the exam

Semester 3.

2. Advanced Biochemistry, Biophysics, Molecular Cell Biology, and Pharmacology II. (Molecular Cell Biology and Biophysics)

Course type: **Lecture**

14 x 3 classes per week, 42 hours per semester, **9 credits**

Head of the course: Prof. Dr. László Dux MD, PhD, DSc, Department of Biochemistry, Faculty of Medicine, University of Szeged, email: dux.laszlo@med.u-szeged.hu

Dr. József Mihály PhD, DSc - Institute of Genetics, Biological Research Center, Szeged
email:

Prof. László Zimányi, PhD, DSc - Institute of Biophysics, Biological Research Center, Szeged
email:

SPECIAL ELECTIVE PHD COURSES:

Animal experiments in medicine – Level A

Course type: **Lecture**

20 hours per semester, **4 credits**

Head of the course: Prof. Mihály Boros MD, PhD, DSc
Institute of Surgical Research, Albert Szent-Györgyi Medical School, University of Szeged
Béla Szőkefalvi –Nagy str. 6., H-6720 Szeged Hungary
Tel: +36-62-545-103, Fax: +36-62-545-743
E-mail: boros.mihaly@med.u-szeged.hu

2. Animal experiments in medicine – Level A

Course type: **Practice**

20 hours per semester, **4 credits**

Head of the course: Prof. Mihály Boros MD, PhD, DSc
Institute of Surgical Research, Albert Szent-Györgyi Medical School, University of Szeged
Béla Szőkefalvi –Nagy str. 6., H-6720 Szeged Hungary
Tel: +36-62-545-103, Fax: +36-62-545-743
E-mail: boros.mihaly@med.u-szeged.hu

3. Introduction to the basics of cardiovascular research I.-IV.

Course type: **Lecture**

28 hours per semester, **5 credits**

Head of the course: Dr. habil. Csaba Csonka PhD
Supervisors: Prof. Dr. Tamás Csont, Dr. Gergő Szűcs PhD
Department of Biochemistry,
Albert Szent-Györgyi Medical School, University of Szeged
H-6720, Szeged, Dóm tér 9, Hungary
Email: csonka.csaba@med.u-szeged.hu

4. Pre-clinical cardiovascular research I.-IV.

Course type: **Lecture**

28 hours per semester, **5 credits**

Head of the course: Dr. habil. Márta Sárközy PhD

Department of Pathophysiology,
Albert Szent-Györgyi Medical School, University of Szeged
Béla Szőkefalvi –Nagy str. 6., H-6720 Szeged Hungary
Email:sarkozy.marta@med.u-szeged.hu

MODULE 2: RESEARCH ACTIVITIES

Compulsory: 5-20 credits per semester, max. 172 credits per 8 semesters

A total No. of **min. 130 credits and max. 172 credits/ 8 semesters** is required (1 credit=30 hours)

The module consists of 2 parts:

- **Experimental research work** 5-20 credits per semester
- **Research report** 3 credits

The total number of reports cannot exceed 4.

Reporting is recommended at the end of semesters 2, 4, 6 and 8, 4 credits =12 credits.

PhD students cannot be allocated more than 172 credits for completing their research activity.

Further *elective* credits can be allocated for other research activities:

Participation in continuing education courses 2 credits

2. Summary of work completed: 3 credits/ summary

max. 12 credits/ 8 semesters

Module 3 Teaching activity (optional)

A total No. of min. 0 and max. 48 credits/ 8 semesters (max. 8 credits/ semester)

- 1 class/week 2 credits
- 2 class/week 4 credits
- 3 class/weeks 6 credits
- 4 class/weekr 8 credits

Note: Credits can only be allocated for teaching activity in the Hungarian language program (giving contact lessons, marking test papers, supervising written exams, participation in oral exams).

Credits cannot be allocated for teaching activities in the English or German program since PhD students receive a fee for those lessons.

Module 4 Publication activity

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

Number of publications required for the completion of the PhD training:

- min. 1 paper where the student is the lead author
- min. 2 original research articles, min. 1 of which is published in a journal with an impact factor and the combined impact factor of the 2 articles has to fulfill the requirements of the subprogram

The number of impact factors required by the Doctoral School of Multidisciplinary Medicine:

1. Experimental Cardiology and Cardiovascular Pharmacology 2.5
2. Biochemistry, Biophysics, Molecular and Cell Biology- 4,0

- The lead author has to issue a statement authorising the PhD student to include the paper in their thesis.

Number of credit points for publication activity:

Poster presentation at a Hungarian event: 3 credits

Poster presentation at an international event: 5 credits

Oral presentation at a Hungarian event: 3 credits

Oral presentation at an international event*: 5 credits

**(also if held in Hungary)*

English article with no IF: 20 credits

English article with IF: 45 credits

Total number of credit points for publication activity (publication, poster and oral presentation): min. 65 – max. 90 credits

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; 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.
- Summary of the work completed: 3 credits for each; minimum 1 maximum 4 summaries can be rewarded by a total of 12 credits.

The training plan consists of 4 parts (modules):

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

Part A Basic module (20 credits)

PhD training plan by English for students of Doctoral School at the University of Szeged, Albert Szent-Györgyi Medical School

Basic Module 1st/subject credit (min. 38 credit)													
Basic modul													
Course name	Name of department coordinator	Total numb er of classic (hours)	Require ments	Number of credits in semesters								Total credits	Evaluation
				1.	2.	3.	4.	5.	6.	7.	8.		
Computer-assisted research methodology	Prof. Dr. Ferenc Peták DSc Department of Medical Physics and Informatics	28	O	-	6	-	-	-	-	-	-	6	B5
Scientific communication and publication. Methods, rules, ethics	Prof.Dr. Ernő Duda Dsc Department of Medical Biology	14	O	-	3	-	-	-	-	-	-	3	B5
Biostatistics Lecture	Prof. Dr. Tibor Nyári Dsc Department of Medical Physics and Informatics	28	O	6	-	(6)	-	-	-	-	-	6	B5
Biostatistics Practical	Prof. Dr. Tibor Nyári Dsc PhD Department of Medical Physics and Informatics	28	O	2	-	(2)	-	-	-	-	-	2	B3
Biomedical Ethics	Dr. habil.Oguz Kelemen PhD Department of Behavioral Scientes	14	O	-	3	-	-	-	-	-	-	3	B5
Total credit of Basic Modul 1-st				8	12	(8)	-	-	-	-	-	20	

1 O (Obligatory subject)

2 E (Elective subject)

3 CE (Compulsory elective subject)

Informing students on course requirements
(In accordance with information and study materials available on Coospace)
From February 2025

Program: PhD day- training for SH students and self-cost students
Course: Computer-assisted research methodology
Academic year/Semester: 2024/25 2nd semester
Educator and contact details (e-mail): Prof. Ferenc Peták, email: petak.ferenc@med.u-szeged.hu Dr. József Tolnai, email: tolnai.jozsef@med.u-szeged.hu
Type of course: lecture/ <u>seminar</u> / <u>practice</u> /laboratory
Weekly hours of the course: 2
Credit value of the course: 6
Type of examination: <u>final exam at the end of semester</u> , practice exam, other:-
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): none
Purpose of the course: The primary aim of the course is to provide PhD students with a practical and theoretical background in computer science for the process from data analysis to publication. The course aims to educate students on the use of modern information technologies for effective work in life sciences: processing biomedical data, creating scientific charts and diagrams, preparing and presenting presentations, composing electronic documents (e.g. publications, theses) and surveys. The course also aims to provide insights into new and expanding medical technologies such as telemedicine systems, medical applications of 3D design and printing, and artificial intelligence in life sciences.
Outcome requirements of the course (specific academic results to be established by the course): <u>Knowledge:</u> • Possesses the knowledge needed to process biomedical data into tables. • Being familiar with the basic concepts of spreadsheets (relative, absolute, and mixed references, ranges, data import and input, data validation, autofill, charts, filtering, sorting, diagrams, functions, basic statistical solutions, large tables, linear regression, and pivot tables) • Knows the effective and modern presentation techniques and principles of presentation. Familiar with interactive and none-slide based presentation tools (Prezi, Mentimeter) • Knows the health data available on the web. Also familiar with the methods of preparing and evaluating online forms. • Knows the basic typographic concepts for document editing (styles, table of contents, figures and captions, list of figures), and general document editing principles. Understands the use and benefits of reference management software. • Being familiar with forms and basic concepts of scientific data publication. Knows the information and literature search, and the international scientific life science databases. <u>Competences:</u> • Having the skill to solve tasks on health data in a spreadsheet program. Creates charts, graphs, and pivot tables. Sort and filter data. Apply mathematical and statistical functions.

- Able to create appropriate presentations with animations not only in standard slide-based but also in virtual canvas-based and interactive presentation software.
- Able to find data in open health databases. Capable of creating, sharing, and evaluating online forms.
- Creates, modifies, and applies styles in a word processor, inserts figures and captions, generates table of contents and list of figures, creates a bibliography, manages cross-references, and footnotes.
- Able to use basic telemedicine tools, artificial intelligence and 3D printing techniques in the field of medicine.

Attitudes:

- Confidently apply the spreadsheet techniques they have learned. Strives to maintain data integrity, process, and present data accurately.
- Open to the use of familiar presentation techniques and strives to produce consistent-looking, easy-to-follow presentations.
- Confidently perform search and retrieval tasks from open health databases. Confidently create online questionnaires.
- Strives to apply typographic principles to the production of sophisticated and easy-to-follow electronic and paper-based documents.
- Open to telemedicine applications for the use and development of tools.
- Open to the use of artificial intelligence and 3D printing tools to support medical research.

Autonomy and responsibility:

- Independently solve the spreadsheet and data processing tasks arising in his/her profession.
- Creates and presents his/her electronic presentations independently.
- Autonomously solve the search for open biomedical data.
- Independently create and evaluate online questionnaires.
- Solves word processing and document management tasks independently.
- Independently can interpret the basic concepts of telemedicine, biomedical applications of artificial intelligence, and 3D printing

Topics:

General information, syllabus of the seminars, requirements, IT environment. Basic concepts of computer data collection, representation and processing of measurement data in life sciences.

Computer-assisted data processing methods. Evaluation of medical data with spreadsheets: importing data, input and data validation, references, calculations, functions, filtering, sorting, diagrams, basic statistical solutions, large tables, linear regression, and pivot tables.

Forms and basic concepts of scientific data publication. Presentation of evaluated data, use of graphical software packages (SigmaPlot).

Content and form requirements for scientific presentations. Relationship between design, structure, content and message. Creating scientific presentation: traditional slide-based presentation with PowerPoint, virtual canvas and zooming interface in Prezi, interactive presentation with Mentimeter, PechaKucha

Document processing, use of styles, table of contents, figures and captions, list of figures. Advanced document editing (header, footer, footnote, endnote, cross reference, references), reference management with EndNote, creating online medical surveys and forms.

How do we use artificial intelligence and 3D printing in life sciences?

Information and literature search, use of international scientific life science databases. Electronic systems for managing scientific publications. Reference manager.

Supporting methods to achieve learning outcomes:

Teaching methods:

The practices are done as frontal work (projected task solution, explanation, questioning, discussion) followed by individual or group work.

We help students with their personalized learning using practical handouts and self-developed e-learning materials uploaded to CooSpace.

Students participating in the course will get homework related to topics covered in the seminars to receive bonus points in the final exam.

Evaluation of the acquisition of expected learning outcomes:**Requirements:**

- active participation in seminars
- preparation and submission of homework and examination documents by the deadline

Assessment of acquired skills and competences:

The assessment for the semester is graded with a practical mark which depends on the results of the mid-term and end-of-semester tasks.

Maximum number of points you can get for the exam: 200

Maximum points for mid-semester homework: 100

Total points that can be collected: 300

Attendance at seminars will be honored with additional bonus points.

Grades of the course are determined as follows:

0 - 139 points: failed (1)

140 - 179 points: passed (2)

180 - 219 points: accepted (3)

220 - 259 points: good (4)

260 - 300 points: excellent (5)

Mandatory and recommended reading list:

All handouts for the seminars will be available on the CooSpace scene.

Indicating course requirements on CooSpace scene (summary)**Description (public):**

The primary aim of the course is to provide PhD students with a practical and theoretical background in computer science for the process from data analysis to publication.

The course aims to educate students on the use of modern information technologies for effective work in life sciences: processing biomedical data, creating scientific charts and diagrams, preparing and presenting presentations, composing electronic documents (e.g. publications, theses) and surveys.

The course also aims to provide insights into new and expanding medical technologies such as telemedicine systems, medical applications of 3D design and printing, and artificial intelligence in life sciences.

Requirements:

- active participation in seminars
- preparation and submission of homework and examination documents by the deadline

Assessment of acquired skills and competences:

The assessment for the semester is graded with a practical mark which depends on the results of the mid-term and end-of-semester tasks.

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Topics:

General information, syllabus of the seminars, requirements, IT environment. Basic concepts of computer data collection, representation and processing of measurement data in life sciences.

Computer-assisted data processing methods. Evaluation of medical data with spreadsheets: importing data, input and data validation, references, calculations, functions, filtering, sorting, diagrams, basic statistical solutions, large tables, linear regression, and pivot tables.

Forms and basic concepts of scientific data publication. Presentation of evaluated data, use of graphical software packages (SigmaPlot).

Content and form requirements for scientific presentations. Relationship between design, structure, content and message. Creating scientific presentation: traditional slide-based presentation with PowerPoint, virtual canvas and zooming interface in Prezi, interactive presentation with Mentimeter, PechaKucha

Document processing, use of styles, table of contents, figures and captions, list of figures. Advanced document editing (header, footer, footnote, endnote, cross reference, references), reference management with EndNote, creating online medical surveys and forms.

How do we use artificial intelligence in life sciences?

Information and literature search, use of international scientific life science databases. Electronic systems for managing scientific publications. Reference manager.

Informing students on course requirements

(In accordance with information and study materials available on Coospace)

From February 2025

Program: PhD day- training for SH students and self-cost students

Course:

Scientific communication and publication. Methods, rules, ethics.

Academic year/Semester: **2024/2025, 2nd.**

Educator and contact details (e-mail): **Prof. Dr. Ernő Duda DSc, duda@brc.hu**

Type of course: **lecture**/seminar/practice/laboratory

Lectures

Exam date:

Weekly hours of the course: **1** (14 hours)

Credit value of the course: **3**

Type of examination: final exam at the end of semester, practice exam, other: final written exam at the end of semester (brief answer questions)

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 to navigate in the (natural) sciences of 21st century. Planning, execution, documentation of experiments. Reproducibility, significance of results. Ways and tools of scientific communication. Posters, oral presentations, publications, PhD theses, chapters, book, patents. Open science, open access, blockchain in science. Peer review, predatory journals, 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) collaborations, how to form consortia, where to find scientific courses, calls for scientific proposals, 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 conventions

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 century

Forms and rules of scientific communication

Scientific literature, databases, impact, citations

Scientific career

Phases of the scientific career

Requirements of success in different phases

World science, collaborations, networks

Your proposals, your project, your own team

Know your skills and talents!

Different paths after PhD

Challenges in the 21st century

Irreproducible research: mistakes, fabrications, plagiarism

Plagiarism-detecting software, corrections, 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 exam 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, 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 information and study materials available on CooSpace)

Most nem indult, jövőre tudják felvenni a hallgatók

From September 2025

Program: Ph.D. day- training for SH students and self-cost students

Course: **Biostatistics lecture**

Academic year/Semester: 2025/26 1st semester

Educator and contact details (e-mail):

Stéhlik Jánosné Dr. Boda Krisztina boda.krisztina@med.u-szeged.hu

Dr. Nyári Tibor nyari.tibor@med.u-szeged.hu

Szűcs Mónika szucs.monika@med.u-szeged.hu

Type of course: **lecture**/seminar/practice/laboratory

Weekly hours of the course: 2

Credit value of the course: 6

Type of examination: final exam at the end of semester, practice exam, other:.....

Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course):

Purpose of the course:

The aim of this course is to familiarize students with the most commonly used statistical methods in the clinical and research fields of medicine, enabling them to apply these methods. Students will also learn to correctly interpret statistical results from statistical software or medical articles.

Throughout the course, students will learn the concepts of data and databases. They will be able to formulate hypotheses specific to a given experimental design, create the necessary database, determine the types of variables within the database, and describe their distribution.

Students will become familiar with the methods of hypothesis testing commonly used in medical research and with the fundamentals of statistical modeling. They will learn how to select appropriate statistical methods to test hypotheses, run statistical analyzes using statistical programs, and draw appropriate statistical and medical conclusions based on the results, interpreting them according to industry standards. In addition, they will learn when it is necessary to involve a statistician in the research process.

Topics:

1. Introduction. Data description.

Types of data, display of 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, box diagram). Population, sample.

2. Basics of Probability Theory I.

The concept of probability, rules of probability calculus. Odds, odds ratio. Definition of a categorical variable, the distribution, expected value, and variance of a categorical variable. Special discrete distributions: the binomial and Poisson distributions.

3. Basics of Probability Theory II.

Conditional probability, diagnostic tests. The distribution of continuous variables, the density function. The normal distribution. Standardization, the binomial test as an application of standardization.

4. Statistical estimation.

The central limit theorem; the standard error of the mean. The concept of a confidence interval. Confidence interval for the odds ratio. Confidence interval for the population mean. The t-distribution, the use of Student's t-table. Hypothesis tests: one sample t-test, binomial test.

5. Statistical inference, t-tests

One sample, paired, and independent samples t-test. Comparison of

variances (F-test). One- and two-tailed tests.

6. Correlation-regression analysis.

Single and multiple linear regression. Linear regression on transformed data.

7. The chi-square test for independence

Assumptions, Fisher exact test

8. Statistical errors

Type I and II errors, statistical power. The basics of sample size calculation

9. Analysis of variance

Principle of one-way ANOVA, F-test, pairwise comparisons. Repeated measurements ANOVA.

10. Nonparametric methods based on ranks

Wilcoxon-test, Mann-Whitney test, Kruskal-Wallis test

11. 2x2 tables in epidemiology

Cohen-Kappa, relative risk, odds ratio, logistic regression.

12. Survival analysis

Life-table, Kaplan-Meier method

13. Multivariate methods

Factor analysis, cluster analysis, discriminant analysis. The aim and most important properties.

Supporting methods to achieve learning outcomes:

Teaching methods:

In addition to giving theoretical background, we give practical examples based on medical and biological research papers to show the application of the methods in practice.

Requirements:

The final grade is determined on the total score, where the total score is the sum of the points obtained in practice and the final exam.

The grades are awarded as follows on the total score:

- 0 - 101.99 points: Fail (1)
- 102 - 125.99 points: Pass (2)
- 126 – 151.99 points: Average (3)
- 152 – 175.99 points: Good (4)
- 176 - : Excellent (5)

Exam Test

Exams are held in the classrooms of the Small Educational Building in the form of a CooSpace test. The tests cover the entire semester's practical and theoretical material, with a special focus on the use of statistical software. auxiliary materials are not allowed during the exam.

To register for the exam, students must register through the Neptun system, and registration will automatically close 24 hours before the exam begins.

The duration of the exam test is 40 minutes, and a maximum of 100 points can be

earned.

Mandatory reading list:

Students can download course material (handouts, lecture notes) from Coospace. Making notes at lectures will help in preparing for the exam.

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 this course is to familiarize students with the most commonly used statistical methods in the clinical and research fields of medicine, enabling them to apply these methods. Students will also learn to correctly interpret statistical results from statistical software or medical articles.

Throughout the course, students will learn the concepts of data and databases. They will be able to formulate hypotheses specific to a given experimental design, create the necessary database, determine the types of variables within the database, and describe their distribution.

Students will become familiar with the methods of hypothesis testing commonly used in medical research and with the fundamentals of statistical modeling. They will learn how to select appropriate statistical methods to test hypotheses, run statistical analyzes using statistical programs, and draw appropriate statistical and medical conclusions based on the results, interpreting them according to industry standards. In addition, they will learn when it is necessary to involve a statistician in the research process.

Requirements:

Attendance of lectures is strongly recommended; downloading lecture slides cannot substitute for participation in the lecture. The course ends with an end-semester examination.

The lectures are complemented by a practical course whose aim is to help students reach a deeper understanding of the lecture material.

Examination Requirements

Students who do not meet the course requirements cannot take the examination.

The final grade is determined on the total score, where the total score is the sum of

the points obtained in practice and the final exam.

The grades are awarded as follows on the total score:

- 0 - 101.99 points: Fail (1)
- 102 - 125.99 points: Pass (2)
- 126 – 151.99 points: Average (3)
- 152 – 175.99 points: Good (4)
- 176 - Excellent (5)

Exam Test

Exams are held in the classrooms of the Small Educational Building in the form of a CooSpace test. The tests cover the entire semester's practical and theoretical material, with a special focus on the use of statistical software. auxiliary materials are not allowed during the exam.

To register for the exam, students must register through the Neptun system, and registration will automatically close 24 hours before the exam begins.

The duration of the exam test is 40 minutes, and a maximum of 100 points can be earned.

Topics:

1. Introduction. Data description.

Types of data, display of 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, box diagram). Population, sample.

2. Basics of Probability Theory I.

The concept of probability, rules of probability calculus. Odds, odds ratio. Definition of a categorical variable, the distribution, expected value, and variance of a categorical variable. Special discrete distributions: the binomial and Poisson distributions.

3. Basics of Probability Theory II.

Conditional probability, diagnostic tests. The distribution of continuous variables, the density function. The normal distribution. Standardization, the binomial test as an application of standardization.

4. Statistical estimation.

The central limit theorem; the standard error of the mean. The concept of a confidence interval. Confidence interval for the odds ratio. Confidence interval for the population mean. The t-distribution, the use of Student's t-table. Hypothesis tests: one sample t-test, binomial test.

5. Statistical inference, t-tests

One sample, paired, and independent samples t-test. Comparison of variances (F-test). One- and two-tailed tests.

6. Correlation-regression analysis.

Single and multiple linear regression. Linear regression on transformed data.

7. The chi-square test for independence

Assumptions, Fisher exact test

8. Statistical errors

Type I and II errors, statistical power. The basics of sample size calculation

9. Analysis of variance

Principle of one-way ANOVA, F-test, pairwise comparisons. Repeated measurements ANOVA.

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11. 2x2 tables in epidemiology

Cohen-Kappa, relative risk, odds ratio, logistic regression.

12. Survival analysis

Life-table, Kaplan-Meier method

13. Multivariate methods

Factor analysis, cluster analysis, discriminant analysis. The aim and most important properties.

Course description template

Informing students on course requirements

(In accordance with information and study materials available on Coospace)

From September 2025

Most nem indult, jövőre tudják felvenni a hallgatók

Program: PhD day- training for SH students and self-cost students

Course: **Biostatistic practice**

Academic year/Semester: 2025/26 1st semester

Educator and contact details (e-mail):

Stéhlík Jánosné Dr. Boda Krisztina boda.krisztina@med.u-szeged.hu

Dr. Nyári Tibor nyari.tibor@med.u-szeged.hu

Szűcs Mónika szucs.monika@med.u-szeged.hu

Type of course: lecture/seminar/practice/laboratory

Weekly hours of the course: 2

Credit value of the course: 2

Type of examination: final exam at the end of semester, practice exam, 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 this course is to familiarize students with the most commonly used statistical methods in the clinical and research fields of medicine, enabling them to apply these methods. Students will also learn to correctly interpret statistical results from statistical software or medical articles.

Throughout the course, students will learn the concepts of data and databases. They will be able to formulate hypotheses specific to a given experimental design, create the necessary database, determine the types of variables within the database, and describe their distribution.

Students will become familiar with the methods of hypothesis testing commonly used in medical research and with the fundamentals of statistical modeling. They will learn how to select appropriate statistical methods to test hypotheses, run statistical analyzes using statistical programs, and draw appropriate statistical and medical conclusions based on the results, interpreting them according to industry standards. In addition, they will learn when it is necessary to involve a statistician in the research process.

Outcome requirements of the course (specific academic results to be established by the course):

Topics:**1. Introduction. Data description.**

Types of data, display of 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, box diagram). Population, sample.

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7. The chi-square test for independence

Assumptions, Fisher exact test

8. Statistical errors

Type I and II errors, statistical power. The basics of sample size calculation

9. Analysis of variance

Principle of one-way ANOVA, F-test, pairwise comparisons. Repeated measurements ANOVA.

10. Nonparametric methods based on ranks

Wilcoxon-test, Mann-Whitney test, Kruskal-Wallis test

11. 2x2 tables in epidemiology

Cohen-Kappa, relative risk, odds ratio, logistic regression.

12. Survival analysis

Life-table, Kaplan-Meier method

13. Multivariate methods

Factor analysis, cluster analysis, discriminant analysis. The aim and most important properties.

Supporting methods to achieve learning outcomes:

Teaching methods

We give practical examples based on medical and biological research papers to show the application of the methods in practice.

During the practices, the R, Rcommander programs are used.

Evaluation of the acquisition of expected learning outcomes:

Requirements:

Attendance of the practical part is obligatory. Participating in practical sessions according to the 'Study Guide of the Faculty of Medicine'. Maximum 3 absences are allowed and at least 51% completion 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 that contain practical problems that have to be solved by hand calculations and by a computer program (R, Rcommander). During the tests, the use of calculators, computers (without Internet) and their own notes on a single A4 sheet is allowed.

Evaluation of the course:

The course result is evaluated by a three-grade sign. It will be calculated from the test points (maximum 100 points). For successful completion of the course, the total accomplishment must be at least 51%.

The evaluation of the practical is based on the sum of two tests.

Accomplishment, practice, %	Evaluation
0% -50,99%	Not met requirements /Failed(NOMETRE)
51%-90,99%	Met requirements /Satisfactory

	(METRE/P)t
91%-	Met requirements /Excellent(METRE/H)

Mandatory reading list:

Students can download course material (handouts, lecture notes, R scripts) from Coospace. Making notes at lectures will help in preparing for the exam.

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: Biostatistika 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 this course is to familiarize students with the most commonly used statistical methods in the clinical and research fields of medicine, enabling them to apply these methods. Students will also learn to correctly interpret statistical results from statistical software or medical articles.

Throughout the course, students will learn the concepts of data and databases. They will be able to formulate hypotheses specific to a given experimental design, create the necessary database, determine the types of variables within the database, and describe their distribution.

Students will become familiar with the methods of hypothesis testing commonly used in medical research and with the fundamentals of statistical modeling. They will learn how to select appropriate statistical methods to test hypotheses, run statistical analyzes using statistical programs, and draw appropriate statistical and medical conclusions based on the results, interpreting them according to industry standards. In addition, they will learn when it is necessary to involve a statistician in the research process.

Requirements:

Attendance of the practical part is obligatory. Participating in practical sessions according to the 'Study Guide of the Faculty of Medicine'. Maximum 3 absences are allowed and at least 51% completion of the course (see below).

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, Rcommander) or interpreting R output. During the tests, the use of calculators, computers (without Internet) and

their own notes on a single A4 sheet is permitted.

Evaluation of the course:

The course result is evaluated by a three-grade sign. It will be calculated from the test points (maximum 100 points). For a successful completion of the course, the total accomplishment must be at least 51%.

The evaluation of the practical is based on the sum of two tests.

Accomplishment, practice, %	Evaluation
0% -50,99%	Not met requirements /Failed(NOMETRE)
51%-90,99%	Met requirements /Satisfactory (METRE/P)t
91%-	Met requirements /Excellent(METRE/H)

Topics:

1. Introduction. Data description.

Types of data, display of 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, box diagram). Population, sample.

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5. Statistical inference, t-tests

One sample, paired, and independent samples t-test. Comparison of variances (F-test). One- and two-tailed tests.

6. Correlation-regression analysis.

Single and multiple linear regression. Linear regression on transformed data.

7. The chi-square test for independence

Assumptions, Fisher exact test

8. Statistical errors

Type I and II errors, statistical power. The basics of sample size calculation

9. Analysis of variance

Principle of one-way ANOVA, F-test, pairwise comparisons. Repeated measurements ANOVA.

10. Nonparametric methods based on ranks

Wilcoxon-test, Mann-Whitney test, Kruskal-Wallis test

11. 2x2 tables in epidemiology

Cohen-Kappa, relative risk, odds ratio, logistic regression.

12. Survival analysis

Life-table, Kaplan-Meier method

13. Multivariate methods

Factor analysis, cluster analysis, discriminant analysis. The aim and most important properties.

Informing students on course requirements
(In accordance with information and study materials available on Coospace)
From february 2025

Program: PhD day- training for SH students and self-cost students
Course: Biomedical ethics
Academic year/Semester: 2024/2025 2 nd
Educator and contact details (e-mail): Gergely Tari PhD , assistant professor, email: tari.gergely.robert@med.u-szeged.hu
Type of course: lecture/seminar/ practice /laboratory
Weekly hours of the course: 7*2 hours
Credit vale of the course: 3 credits
Type of examination: final exam at the end of semester, practice exam , 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 reflexion is often necessary before using them routinely in the daily medical practice. The aim of the course is to interpret all the bioethical principles (Patient autonomy, non-maleficence, beneficence, justice) to our students as well the international laws that are regulating biomedical research. Course is recommended to all, who is 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 approach 3. Basics of animal experimentation - international ethical and legal approach 4. Ethical implications regarding biomedical research on human subjects 5. Ethical issues of human reproduction (with special regard to <i>in vivo</i> and <i>in vitro</i> fertilization) 6. „Gene-ethics” (PGT; 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: - Attendance regulated according to the study and examination rules - Grade is given according to attendance - Written test should be written for those students who have absences
Mandatory reading list: Lewis Vaughn: Bioethics. Principles, Issues, and Cases. Oxford University Press, 2022.
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 reflexion is often necessary before using them routinely in the daily medical practice. The aim of the course is to interpret all the bioethical principles (Patient autonomy, non-maleficence, beneficence, justice) to our students as well the international laws that are regulating biomedical research. Course is recommended to all, who is 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:

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

Topics:

1. Introduction to bioethics
2. Basics of human subject research – international ethical and legal approach
3. Basics of animal experimentation - international ethical and legal approach
4. Ethical implications regarding biomedical research on human subjects
5. Ethical issues of human reproduction (with special regard to *in vivo* and *in vitro* fertilization)
6. „Gene-ethics” (PGT; 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:

Lewis Vaughn: Bioethics. Principles, Issues, and Cases. Oxford University Press, 2022.

Recommended reading list:

Sinaci, M., Sorgner, S.F. (szerk.): Ethics of Emerging Biotechnologies. From Educating the Young to Engineering Posthumans. Trivent Publishing, Budapest, 2018.

Sum of all compulsory training credits (basic and subprogram (specialization) credits: $20 + 18 = 38$ credits
Compulsory subjects of the 2 subprograms of the Doctoral School of Multidisciplinary Medicine, University of Szeged, of which min. 18 credits must be collected in Semesters 1–4:

This Student Circle give the possibility for the Stipendium Hungaricum students to get familiar with the Basic Cardiac electrophysiology.

Studnet Circle coordinator: Norbert Jost, PhD, DSc, associate professor

The Curriculum is as follow:

1.	02.09	Introduction	Dr. Norbert Jost
2.	02.16.	Basic principles of electrophysiology, the impulse propagation	Dr. Norbert Nagy
3.	02.23.	Cardiac electrophysiological measurement techniques	Dr. László Virág
4.	03.02.	The cardiac action potential and underlying ionic currents I.	Dr. Norbert Jost
5.	03.09.	The cardiac action potential and underlying ionic currents I.	Dr. Norbert Jost
6.	03.16.	Excitation-contraction mechanism	Dr. Norbert Nagy
7	03.23.	Genetic dysfunctions of ion channels: cellular basis	Dr. János Prorok
8.	03.30.	Basic mechanisms of cardiac arrhythmias	Dr. Norbert Jost
9.	04.13.	The physiological ECG and the basis of ECG diagnostics	Dr. Zoltán Husti
10.	04.20.	Sudden cardiac deaths in top athletes	Dr. Attila Farkas
11.	04.27.	Electrophysiology of the heart failure	Dr. Norbert Nagy
12.	05.04.	Electrophysiology of the atrial fibrillation	Dr. Norbert Jost
13.	05.11.	Electrophysiology of the ischemia-reperfusion injury	Dr. Norbert Nagy
14.	05.18.	Sex differences in cardiac electrophysiology	Dr. Norbert Nagy

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		

		(hours)											
Advanced Biochemistry, Biophysics, Molecular Cell Biology, and Pharmacology I. (Biochemistry and Cardiac Electrophysiology and the mechanism of the arrhythmias)	Department of Biochemistry - Prof. Dr. László Dux; Department of Pharmacology and Pharmacotherapy - Prof. Dr. András Varró	28	C	-	9	-	-	-	-	-	-	9	E5
Advanced Biochemistry, Biophysics, Molecular Cell Biology, and Pharmacology II. (Molecular and Cell Biology and Biophysics)	Department of Biochemistry Prof. Dr. László Dux, - Institute of Genetics, BRC - József Mihály, Res. - Institute of Biophysics, BRC - Prof László Zimányi	28	C	-	-	9	-	-	-	-	-	9	E5
<i>The total No. of credits for the compulsory subjects in the PhD sub-program (specialization)</i>				-	9	9	-					18	
<i>All compulsory trainings credits (the total No. of credits in the Basic module and for the compulsory subjects related to the PhD subprogram (specialization))</i>				8	21	9	-	-	-	-	-	38	

1. Advanced Biochemistry, Biophysics, Molecular Cell Biology, and Pharmacology I.

(Biochemistry and Cardiac Electrophysiology and the mechanism of the arrhythmias)

Course type: Lecture

14 x 3 classes per week, 42 hours per semester, 9 credits

I. Schedule of Biochemistry: The course runs from 3 April to 22 May, every Wednesday from 14.00 to 17.00.

Place: Department of Biochemistry, Seminar Room, 6720 Szeged, Dóm tér 9.

email: dux.laszlo@med.u-szeged.hu. Tel: +36-62-54-5096

Head of course and Supervisors: Prof. Dr. László Dux MD, PhD, DSc, Department of Biochemistry, Albert Szent-Györgyi Medical School, University of Szeged,

II- Schedule of Pharmacology: The course starts on February 15, and runs to March 28, every Tuesday from 15.00 to 18:00.

Place: Department of Pharmacology and Pharmacotherapy, Library, 6720 Szeged, Dóm tér 12.

Prof. András Varró MD, PhD, DSc - Department of Pharmacology and Pharmacotherapy, Albert Szent-Györgyi Medical School, University of Szeged

Dr. habil. Norbert Jost PhD - Department of Pharmacology and Pharmacotherapy, Albert Szent-Györgyi Medical School, University of Szeged

Email: jost.norbert@med.u-szeged.hu Tel: +36-62-54-6885

Biochemistry

1. Membranes I. Apr 3, 2024, 14:00-17:00

Lecturer: Prof. Dr. László Dux MD PhD DSc,
Department of Biochemistry
e-mail: laszlo.dux@med.u-szeged.hu

2. Crystallization of membrane proteins . Apr 10, 2024, 14:00-17:00

Lecturer: Dr. Gerda Szakonyi PharmD PhD habil, associate professor
Faculty of Pharmacy, Institute of Pharmaceutical Analysis
e-mail: gerda.szakonyi@pharm.u-szeged.hu

3. Membranes II. Apr 17, 2024, 14:00-17:00

Lecturer: Prof. Dr. László Dux MD PhD, PhD
Department of Biochemistry
e-mail: laszlo.dux@med.u-szeged.hu

4. Molecular Signalling I. May 8, 2024, 13:00-16:00

Lecturer: Dr. Anikó Keller-Pintér MD PhD habil, associate professor
Department of Biochemistry
e-mail: keller.aniko@med.u-szeged.hu

5. Molecular Signalling II. May 8, 2024 16:00-19:00

Lecturer: Dr. Anikó Keller-Pintér MD PhD habil, associate professor
Department of Biochemistry
e-mail: keller.aniko@med.u-szeged.hu

6. Non-coding RNAs May 15, 2024, 14:00-17:00

Lecturer: Dr. Márta Sárközy MD PhD habil, associate professor
Department of Pathophysiology
e-mail: marta.sarkozy@med.u-szeged.hu

7. Molecular mechanisms of cardiac fibrosis and hypertrophy May 22, 2024, 14:00-17:00

Lecturer: Dr. Márta Sárközy MD PhD habil, associate professor
Department of Pathophysiology
e-mail: marta.sarkozy@med.u-szeged.hu

2.Tárgycsoport neve:	Advanced Biochemistry, Biophysics, Molecular Biology and Pharmacology
1.Tárgy neve:	Advanced Biochemistry, Biophysics, Molecular Biology and Pharmacology II.
Szervezeti egység neve (felelős tanszék):	SZTE SZAOK Biokémia Intézet, HUN-RENSZBK Genetikai Intézet, HUN-REN SZBK Biofizikai Intézet
Tárgyfelelős neve:	Prof. Dr. Dux László egyetemi tanár, doktori iskola vezető
Tárgy vezető oktatói:	Dr. Mihály József tudományos tanácsadó, Prof. Dr. Zimányi László tudományos tanácsadó
Kurzus előfeltétele:	nincs
Kurzus meghirdetése	2., 3, vagy 4. félév
Kurzus javasolt felvétele:	a képzés 1-4. félévében
Heti óraszám:	3
Összes óraszám:	42
Órarendi adatok:	2024.03.08-tól - 05.18-ig, pénteken 10:00 -13:00 óra között, előadások helyszíne: SZBK, 6726 Szeged, Temesvári krt. 62.
Kreditpont:	9
Követelmény típus (teljesítés módja):	ötfokozatú beszámoló
Kurzus felvételek max. száma:	1 (A tárgyelem nem ismételhető)
Kurzushirdető tanszék:	SZTE SZAOK Biokémia Intézet közösen az SZBK Genetikai Intézetével és az SZBK Biofizikai Intézetével
Kurzus típusa:	elméleti
Kurzuson résztvevők száma	Limitált (max.15 fő)
Vizsgatípus:	szóbeli
A kurzus oktatói:	Dr. Mihály József, Dr. Szikora Szilárd, Dr. Timinszky Gyula, Dr. Juhász Gábor, Dr. Burkovics Péter, Dr. Honti Viktor; Dr. Zimányi, László, Dr. Szalontai Balázs, Dr. Páli Tibor, Dr. Ormos Pál, Dr. Bagyinka Csaba, Dr. Végh, Attila Gergely, Dr. Patai Roland
Tematika:	Cytoskeleton regulation from a formin point of view Genome editing Advanced fluorescent microscopic techniques Autophagy DNA repair Hemocyte differentiation Electronic spectroscopy and biological applications Vibrational (infrared and Raman) spectroscopy and biological applications Macromolecular structure (protein, DNA, membrane), interaction and molecular modeling Optical micromanipulation, microspectroscopy, molecular interactions Protein crystallography, X-ray-, electron- and neutron diffraction Scanning (AFM, STM, ...) microscopy and biological applications Electron microscopy and biological applications
Ajánlott irodalom:	-

Cardiac Electrophysiology and the mechanism of the arrhythmias

PhD course

Supervisor: Prof Dr. Norbert Jost

1. Basic principles of electrophysiology, the impulse propagation in the heart

Lecturer: Dr. Norbert Nagy

Transmembrane transport, Donnan equilibrium, resting potential,
Nernst equation, ion channels, Local and action potentials

2. The action potential and the underlying ionic currents

Lecturer: Prof. Dr. Norbert Jost

Depolarization and repolarization activated currents, refractoriness
Relation between the action potential and the ECG
Action potential and currents
 Na^+ , K^+ and Ca^{2+} currents, Other currents

3. Excitation-contraction coupling in cardiomyocytes

Lecturer: Dr. Norbert Nagy

Major cellular structures involved in E-C coupling
Cardiac action potentials and ion channels
Na/Ca exchange and the sarcolemmal Ca-pump
Control of cardiac contraction by SR and SL Ca fluxes
Cardiac inotropy, Ca „mismanagement”

4. Investigational techniques in cardiac electrophysiology

Lecturer: Prof. Dr. Norbert Jost and Dr. Norbert Nagy

Action potential measurements
Patch-clamp technique
Isolated heart (Langendorff perfused heart) technique

5. The mechanism of the cardiac arrhythmias

Lecturer: Prof Dr. Norbert Jost

Automatic activity
Disorder of the automaticity (EADs and DAD)s
Re-entry arrhythmias, AV nodal re-entry
The arrhythmogenic mechanism of the repolarization inhomogeneity

6. Genetic background of ion-channel disturbances in the heart

Lecturer: Dr. Demeter-Haludka Vivien

The classification of human genetic diseases
The molecular structure of the cardiac ion channels
Hereditary ion channel diseases

7. The physiological ECG and the basis of ECG diagnostics

Lecturer: Dr. Zoltán Husty

ECG and action potential
The description of the ECG

Each course is 3 hours lecture (3 x 45 minutes block). Each course is supposed to a topic at the exam.

Attendance at lectures is strongly recommended, since there is not available adequate lecture notes on the topics covered in the lectures.

Advanced Biochemistry, Biophysics, Molecular Biology and Pharmacology I.

PhD exam topics

No	Lecturer	Topics
1.	Prof. Dr Norbert Jost	The cardiac action potential, and the main underlying currents.
2.	Dr. Gerda Szakonyi Prof. Dr. László Dux	The role of high-resolution membrane protein structures in drug research
3.	Dr Márta Sárközy	The role of microRNAs in regulatory processes
4.	Dr Anikó Keller-Pintér	Signal transduction systems and their investigating possibilities

Elective subject related to the PhD subprogram (specialization)													
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		
Theory of animal experiments in medicine – Level A	Institute of Surgical Research - Prof. Mihály Boros,	28	E	-	-	6	-	-	-	-	-	6	E5
Student Circle – lectures in cardiovascular electrophysiology	Department of Pharmacology and Pharmacotherapy - Prof. Dr. András Varró	28	E	-	-	-	6	-	-	-	-	6	E5
The total No. of credits for the elective subject in the PhD sub-program (specialization)				-	-	6	6					12	

Theory of animal experiments in medicine – Level A

Course Group Name:	Theory and Practice of Animal Experiments - Level A
1. Course Name:	Theory and Practice of Animal Experiments - Level A (Theory)
Course Type	Elective
	Recommended to be offered as a central course by SZTE ÁOK
Responsible Organizational Unit (Department):	SZTE ÁOK Institute of Surgical and Operative Techniques
Course Coordinator:	Dr. Mihály Boros
Prerequisite:	none
Course Offered:	Academic Year 1st semester (1st or 3rd semester)
Recommended semester to take:	1st or 3rd semester of the program
Weekly Hours:	2
Total Hours:	28
Credit Points:	6
Type of Completion (Requirement):	Five-grade report
Maximum Course Registrations:	1 (The course cannot be repeated)
Department Advertising the Course:	SZTE ÁOK Institute of Surgical and Operative Techniques
Course Type:	Theoretical
Number of Students:	Limited (max. 15 students)
Exam Type:	Written
Course Instructors:	Dr. Mihály Boros, Dr. József Kaszaki, Dr. Andrea Szabó, Dr. Dániel Érces, Dr. Petra Hartmann, Dr. Gabriella Varga, Dr. Marietta Poles, Dr. Szabolcs Tallósy, Dr. László Juhász
Syllabus Topics:	1. Theoretical background and significance of animal experiments; Animal models in biomedical research;
	2. Legal regulation of animal experiments, requirements of Replacement, Reduction, Refinement (3Rs); permission procedures
	3. Species-specific biology, anatomy, physiology, genetics, immunogenetics, and behavioral biology of experimental animals (rodents) Part I
	4. Species-specific biology, anatomy, physiology, genetics, immunogenetics, and behavioral biology of large experimental animals Part II
	5. Handling and treatment of animals
	6. Legal regulation and environmental enrichment of experimental animal husbandry; Hygiene levels of experimental animals and facilities; Operation of animal houses
	7. Recognition of pain, suffering, and stress; general rules of anesthesia and analgesia
	8. Humane endpoints and euthanasia
	9. Ethical aspects of animal experiments; welfare considerations; arguments for and against the scientific use of animals
	10. Basic surgical principles, asepsis rules, basic surgical interventions and wound management
	11. Experiment planning; monitoring, recording, and documentation of life phenomena
	12. Design and implementation of experiments and projects; processing of experimental data
	13. Outbred, inbred, and transgenic animals, cloning, genetic modification
	14. Replacement of animal experiments - "alternative" methods
Recommended Literature:	The theory and practice of animal experiments – university notes (2016)

Course Group Name:	Theory and Practice of Animal Experiments - Level A
2. Course Name:	Theory and Practice of Animal Experiments - Level A (Practice)
Course Type	Elective
	Recommended to be offered as a central course by SZTE ÁOK
Responsible Organizational Unit (Department):	SZTE ÁOK Institute of Surgical and Operative Techniques
Course Coordinator:	Dr. Mihály Boros
Prerequisite:	none
Course Offered:	Academic Year 1st semester (1st or 3rd semester)
Recommended semester to take:	1st or 3rd semester of the program
Weekly Hours:	2 (over 10 weeks)
Total Hours:	20
Credit Points:	3
Type of Completion (Requirement):	Five-grade report
Maximum Course Registrations:	1 (The course cannot be repeated)
Department Advertising the Course:	SZTE ÁOK Institute of Surgical and Operative Techniques
Course Type:	Practice
Number of Students:	Limited (max. 15 students)
Exam Type:	Practical exam
Course Instructors:	Dr. Mihály Boros, Dr. József Kaszaki, Dr. Andrea Szabó, Dr. Dániel Érces, Dr. Petra Hartmann, Dr. Gabriella Varga, Dr. Marietta Poles, Dr. Szabolcs Tallósy, Dr. László Juhász
Syllabus Topics:	1. Introduction, general information, assessment of basic practical knowledge; Safety training
	2. Practice of legal regulation of animal experiments. Practice of animal welfare and the 3Rs
	3. Behavioral biology in practice; behavioral research methods
	4. Capturing, handling, and moving experimental animals; sex determination
	5. Structure and operation of conventional animal houses – visits; practice of animal care
	6. Minimally invasive interventions without anesthesia: oral administration of drugs in practice; practice of injections and cannulation on phantoms
	7. Calculation of anesthetic doses for different species; anesthesia of rodents, recognition and alleviation of pain. Minimally invasive interventions under anesthesia (biological sampling methods)
	8. Species-specific recognition and assessment of pain, suffering, and stress; definition and application of humane endpoints
	9. Surgical practice: scrubbing in dressing, isolation of the surgical area; practice of surgical knotting and suturing; wound care practice on phantoms
	10. Planning animal experiment projects and licensing procedures (seminar)
Recommended Literature:	The theory and practice of animal experiments – practical notes (2016)

1. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/attachments/77846145/c7377001-26fe-4240-b99d-908e9d90eb75/Allatkiserletek_elmelete_es-gyakorlata-kurzus_adaplapok.docx

2.Tárgycsoport neve:	Pre-clinical cardiovascular research
1. Tárgy neve:	Pre-clinical cardiovascular research I.
Szervezeti egység neve (felelős tanszék):	SZTE SZAOK Kórélettani Intézet
Tárgyfelelős neve:	Dr. habil. Sárközy Márta PhD, egyetemi docens
Kurzus előfeltétele:	nincs
Kurzus meghirdetése	őslév, őszl szemeszter
Kurzus javasolt felvétele:	a képzés 1. félélében
Heti óraszám:	2 óra
Összes óraszám:	28
Kreditpont:	5
Követelmény típus (teljesítés módja):	ötfokozatú beszámoló • angol nyelvű szakmai cikk önálló feldolgozása és prezentálása (15 perces • powerpoint formátumú előadás) 1 alkalommal a félév során + plusz félév • félév végi szóbeli vizsga sikeres teljesítése
Kurzus felvételek max. száma:	1 (A tárgyelem nem ismételhő)
Kurzushirdető tanszék:	SZTE SZAOK Kórélettani Intézet
Kurzuson résztvevők száma	Limitált (max. 10 fő), jóváhagyásos
Kurzus típusa:	elméleti, konzultációs kurzus
Vizsgatípus:	szóbeli
A kurzus oktatói:	Dr. Sárközy Márta PhD, egyetemi docens
Tematika:	The students will learn about current scientific publications in the field of cardiovascular research, develop their literary skills, and individually process and present the latest results published in English. They will also learn and become proficient in the methodology of research relevant to their training under professional supervision
Ajánlott irodalom:	- Braunwald's Heart Disease, 12 th Edition, 2021 - Heart Failure: A Companion to Braunwald's Heart Disease, 2019 - a PhD alprogramban eddig elfogadott kandidátusi, Ph.D. és MTA doktori értekezések, - célzott PubMed kereséssel letölthető tudományos közlemények

2.Tárgycsoport neve:	Pre-clinical cardiovascular research
1. Tárgy neve:	Pre-clinical cardiovascular research II.
Szervezeti egység neve (felelős tanszék):	SZTE SZAOK Kórélettani Intézet
Tárgyfelelős neve:	Dr. habil. Sárközy Márta egyetemi docens
Kurzus előfeltétele:	nincs
Kurzus meghirdetése	félév, tavaszi szemeszter
Kurzus javasolt felvétele:	a képzés 2. félévében
Heti óraszám:	2, hétfő, konzultációs kurzus
Összes óraszám:	28
Kreditpont:	5
Követelmény típus (teljesítés módja):	ötfokozatú beszámoló • angol nyelvű szakmai cikk önálló feldolgozása és prezentálása (15 perces • powerpoint formátumú előadás) 1 alkalommal a félév során + plusz félév • félév végi szóbeli vizsga sikeres teljesítése
Kurzus felvételek max. száma:	1 (A tárgyelem nem ismételhető)
Kurzushirdető tanszék:	SZTE SZAOK Kórélettani Intézet
Kurzuson résztvevők száma	Limitált (max. 10 fő), jóváhagyásos
Kurzus típusa:	elméleti, konzultációs kurzus
Vizsgatípus:	szóbeli
A kurzus oktatói:	Dr. Sárközy Márta PhD, egyetemi docens
Tematika:	The students will learn about current scientific publications in the field of cardiovascular research, develop their literary skills, and individually process and present the latest results published in English. They will also learn and become proficient in the methodology of research relevant to their training under professional supervision.
Ajánlott irodalom:	- Braunwald's Heart Disease, 12th Edition, 2021 - Heart Failure: A Companion to Braunwald's Heart Disease, 2019 - a PhD alprogramban eddig elfogadott kandidátusi, Ph.D. és MTA doktori értekezések, Élzoott PubMed kereséssel letölthető tudományos közlemények

2.Tárgycsoport neve:	Pre-clinical cardiovascular research
1. Tárgy neve:	Pre-clinical cardiovascular research III.
Szervezeti egység neve (felelős tanszék):	SZTE SZAOK Kórélettani Intézet
Tárgyfelelős neve:	Dr. habil. Sárközy Márta PhD, egyetemi docens
Kurzus előfeltétele:	nincs
Kurzus meghirdetése	félév, őszi szemeszter
Kurzus javasolt felvétele:	a képzés 1. félévében
Heti óraszám:	2 óra, konzultációs kurzus
Összes óraszám:	28
Kreditpont:	5
Követelmény típus (teljesítés módja):	ötfokozatú beszámoló • angol nyelvű szakmai cikk önálló feldolgozása és prezentálása (15 perces • powerpoint formátumú előadás) 1 alkalommal a félév során + plusz félév • félév végi szóbeli vizsga sikeres teljesítése
Kurzus felvételek max. száma:	1 (A tárgyelem nem ismételhető)
Kurzushirdető tanszék:	SZTE SZAOK Kórélettani Intézet
Kurzuson résztvevők száma	Limitált (max. 10 fő), jóváhagyásos
Kurzus típusa:	elméleti
Vizsgatípus:	szóbeli
A kurzus oktatói:	Dr. Sárközy Márta PhD, egyetemi docens
Tematika:	The students will learn about current scientific publications in the field of cardiovascular research, develop their literary skills, and individually process and present the latest results published in English. They will also learn and become proficient in the methodology of research relevant to their training under professional supervision
Ajánlott irodalom:	- Braunwald's Heart Disease, 12th Edition, 2021 - Heart Failure: A Companion to Braunwald's Heart Disease, 2019 - a PhD alprogramban eddig elfogadott kandidátusi, Ph.D. és MTA doktori értekezések, Élzott PubMed kereséssel letölthető tudományos közlemények

2.Tárgycsoport neve:	Pre-clinical cardiovascular research
1. Tárgy neve:	Pre-clinical cardiovascular research IV.
Szervezeti egység neve (felelős tanszék):	SZTE SZAOK Kórélettani Intézet
Tárgyfelelős neve:	Dr. habil. Sárközy Márta PhD, egyetemi docens
Kurzus előfeltétele:	nincs
Kurzus meghirdetése	félév, őszi szemeszter
Kurzus javasolt felvétele:	a képzés 1. félévében
Heti óraszám:	2 óra, konzultációs kurzus
Összes óraszám:	28
Kreditpont:	5
Követelmény típus (teljesítés módja):	ötfokozatú beszámoló • angol nyelvű szakmai cikk önálló feldolgozása és prezentálása (15 perces • powerpoint formátumú előadás) 1 alkalommal a félév során + plusz félév • félév végi szóbeli vizsga sikeres teljesítése
Kurzus felvételek max. száma:	1 (A tárgyelem nem ismételhető)
Kurzushirdető tanszék:	SZTE SZAOK Kórélettani Intézet
Kurzuson résztvevők száma	Limitált (max. 10 fő), jóváhagyásos
Kurzus típusa:	elméleti
Vizsgatípus:	szóbeli
A kurzus oktatói:	Dr. Sárközy Márta PhD, egyetemi docens
Tematika:	The students will learn about current scientific publications in the field of cardiovascular research, develop their literary skills, and individually process and present the latest results published in English. They will also learn and become proficient in the methodology of research relevant to their training under professional supervision.
Ajánlott irodalom:	- Braunwald's Heart Disease, 12th Edition, 2021 - Heart Failure: A Companion to Braunwald's Heart Disease, 2019 - a PhD alprogramban eddig elfogadott kandidátusi, Ph.D. és MTA doktori értekezések, Élőzött PubMed kereséssel letölthető tudományos közlemények

Student Circle – lectures in cardiovascular electrophysiology

This Student Circle give the possibility for the Stipendium Hungaricum students to get familiar with the Basic Cardiac electrophysiology.

The courses will be organized online live at Zoom platform.

Studnet Circle coordinator: Norbert Jost, PhD, DSc, associate professor

The Curriculum is as follow:

Date: Tuesday 16:00-18:00

1.	02.09	Introduction	Dr. Norbert Jost
2.	02.16.	Basic principles of electrophysiology, the impulse propagation	Dr. Norbert Nagy
3.	02.23.	Cardiac electrophysiological measurement techniques	Dr. László Virág
4.	03.02.	The cardiac action potential and underlying ionic currents I.	Dr. Norbert Jost
5.	03.09.	The cardiac action potential and underlying ionic currents I.	Dr. Norbert Jost
6.	03.16.	Excitation-contraction mechanism	Dr. Norbert Nagy
7	03.23.	Genetic dysfunctions of ion channels: cellular basis	Dr. János Prorok
8.	03.30.	Basic mechanisms of cardiac arrhythmias	Dr. Norbert Jost
9.	04.13.	The physiological ECG and the basis of ECG diagnostics	Dr. Zoltán Husti
10.	04.20.	Sudden cardiac deaths in top athletes	Dr. Attila Farkas
11.	04.27.	Electrophysiology of the heart failure	Dr. Norbert Nagy
12.	05.04.	Electrophysiology of the atrial fibrillation	Dr. Norbert Jost
13.	05.11.	Electrophysiology of the ischemia-reperfusion injury	Dr. Norbert Nagy
14.	05.18.	Sex differences in cardiac electrophysiology	Dr. Norbert Nagy

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 <i>a total No. of 300 hours/semester)</i>	Department of Biochemistry Prof. Dr. László Dux	300	CE	10	10	10	10	10	10	10	10	10		E3
Research activity Semesters 1–8 <i>a total No. of 450 hours/semester)</i>	Department of Biochemistry Prof. Dr. László Dux	450	CE	15	15	15	15	15	15	15	15	15		E3
Research activity Semesters 1–8 <i>a total No. of 600 hours//semester)</i>	Department of Biochemistry Prof. Dr. László Dux	600	CE	20	20	20	20	20	20	20	20	20		E3
Research report (<i>Up to 4 times/8 semesters)</i>	Department of Biochemistry Prof. Dr. László Dux	14	C	-	3	-	3	-	3	-	3	3	12	E3
<i>The total No. of credits for the Research activity</i>				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. 23	min. 10, max. 23	min. 10, max. 23	min. 130, max. 172	

Module 3 Teaching activity (max. 8 credits can be given /semester, a 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 Biochemistry Prof. Dr. László Dux	14	E	2	2	2	2	2	2	2	2		E3
Teaching activity Semesters 1–8 (2 hours/week)	Department of Biochemistry Prof. Dr. László Dux	28	E	4	4	4	4	4	4	4	4		E3
Teaching activity Semesters 1–8 (3 hours/week)	Department of Biochemistry Prof. Dr. László Dux	42	E	6	6	6	6	6	6	6	6		E3
Teaching activity Semesters 1–8 (4 hours/week)	Department of Biochemistry Prof. Dr. László Dux	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
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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 (hours)	Requirements	Number of credits in the given semesters								Total No. of credits	Form of evaluation
				1	2	3	4	5	6	7	8		
English article with no IF (8 hours a week) Semesters 1–8	Department of Biochemistry Prof. Dr. László Dux	112	E	20	20	20	20	20	20	20	20		E3
English article with IF (16 hours a week) Semesters 1–8	Department of Biochemistry Prof. Dr. László Dux	224	C	45	45	45	45	45	45	45	45		E3
Poster presentation at a Hungarian event Semesters 1–8	Department of Biochemistry Prof. Dr. László Dux	14	E	3	3	3	3	3	3	3	3		E3
Poster presentation at an international event (Hungary incl.) Semesters 1–8	Department of Biochemistry Prof. Dr. László Dux	28	E	5	5	5	5	5	5	5	5		E3
Oral presentation at a Hungarian event Semesters 1–8	Department of Biochemistry Prof. Dr. László Dux	14	E	3	3	3	3	3	3	3	3		E3
Oral presentation at an international event Semesters 1–8	Department of Biochemistry Prof. Dr. László Dux	28	E	5	5	5	5	5	5	5	5		E3

The total No. of credits for the Publication activity:		65–81	
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The total No. of credits in Modules 1–4: completion of min. 20, max. 45 credits / semester; a total of min. 240 credits / 8 semesters; max. 360 credits / 8 semesters	*min. 233, max. 289	
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Recommended Curriculum

Min. and max. number of credit points in each semester for full-time students in the 4-year (2+2) program (min. 20, max. 45 credits)

Semester 1:

Subjects in the Basic Module:	6+2 credits = 8 credits
<u>Research activity:</u>	<u>20 credits</u>
Total number of credits:	28 credits

Semester 2:

Subjects in the Basic Module:	6+3+2 credits = 11 credits
Compulsory subject:	9 credits
<u>Research activity and research report:</u>	<u>20+3 credits</u>
Total number of credits:	43 credits

Total number of credits for Semesters 1 and 2: 71 credits

Semester 3:

Compulsory subjects:	9 credits
<u>Research activity:</u>	<u>20 credits</u>
Total number of credits:	29 credits

Semester 4:

Research activity:	20 credits
<u>Research report:</u>	<u>3 credits</u>
Total number of credits:	23 credits

Total number of credits for Semesters 3 and 4: 52 credits

Total number of credits for Semesters 1-4: 71 + 52 credits = 123 credits

Minimum 90 credits should be earned in Semesters 1–4 in order that the student can take the complex examination. The acquisition of 90 credits is feasible for all PhD students.

Semester 5:

<u>Research activity:</u>	<u>20 credits</u>
Total number of credits:	20 credits

Semester 6:

Research activity:	20 credits
<u>Research report:</u>	<u>3 credits</u>
Total number of credits:	23 credits

Total number of credits for Semesters 5 and 6: 43 credits

Semester 7:

<u>Research activity:</u>	<u>20 credits</u>
Total number of credits:	20 credits

Semester 8:

Research activity:	20 credits
<u>Research report :</u>	<u>3 credits</u>
Total number of credits:	23 credits

Total number of credits for Semesters 7 and 8: 43 credits

Summary: total number of credits that can be acquired (compared to the minimum)

Semesters 1-4: 123credits > 90 credits

Semesters 5-8: 86 credits

Semesters 1-8: 123+86= 199 credits

The total number of credit points for publication activity (*min. 65 – max. 90 credits*) is added to this number independent of the semester.

FURTHER REQUIREMENTS

1. Annual summary of the work completed

At the end of each academic year students have to submit a report of max. 1 page that summarizes the work they performed during the year. For the formal requirements of this summary see Appendix 1.

The summary must specify:

- the accurate data of the student and the subprogram (e.g. John Smith, 2nd year full-time PhD student, Neptun ID, email address, name of subprogram, thesis supervisor and institute)
- the courses taken and completed by the student, grades, number of credits
- teaching activities, number of classes and credits (title and code of the subject)
- most important findings of research work
- oral presentations given (event, location, date, title of presentation, certificate, e.g. conference brochure)
- list of publications submitted, accepted and/ or published

The signature of the student's thesis supervisor confirms the truthfulness of the activities listed, whereas the signature of the chair of the doctoral school indicates his/ her approval.

The thesis supervisor, the chair of the Doctoral School and the secretariat of the Doctoral School have to receive a copy of the summary by 15 September of the given year.

2. Language skills

1. All students are required to have a B2 level English language knowledge according the Common European Framework of Reference for Languages (CEFR), which has to be proved by a certificate. The equivalence of language exams and exam certificates is governed by government decrees. If there is no decree to cover certain individual cases, the appraisal of the Department of Foreign Languages has to be asked for.

PhD students participating in teaching at the German Program for students of Medicine and/ or Dentistry may choose to meet the above mentioned requirement by presenting a language certificate of their German language skills.

2. A lower level examination or its equivalent (CEFR level A2 or B1) is required in a second foreign language. Alternatively, a certificate issued by the Department of Foreign Languages is acceptable for this purpose.

3. In the case of foreign citizens whose mother tongue is not Hungarian, their knowledge of that given language entitles them to meet one of the language requirements if it fulfils the regulations of the doctoral school. Hungarian is considered to be a foreign language for such students.

3. Requirements of the complex examination for full-time students in the 2+2-year program

The complex exam is conducted in front of a committee of min. three members, min. one of whom is not employed by the University of Szeged.

1. The chair of the examination committee is a professor of the University of Szeged (SZTE).
2. Another member of the committee is a scientifically qualified researcher of SZTE and the member not employed by SZTE is also scientifically qualified.

The Doctoral School will announce 1-2 dates for the complex examination. Ideally, the examinations are scheduled to take place in the second part of May or the first part of June, so that they will be completed before the entrance exam of the new full-time students.

The complex examination consists of two main parts:

- a. theoretical part (equivalent to the previous final examination): can be re-taken once in the same exam period
- b. dissertation part: the candidate is required to give an account of his or her progress in the chosen field of research as well as his/ her research plans for the next 2 years

Complex examination at the end of Semester 4: consists of 2 parts (50-50%)

- a. theoretical part (equivalent to the previous final examination)

The two subjects for the theoretical part of the complex examination can be selected from a list containing the compulsory courses of the subprogram.

- b. dissertation part: the candidate is required to give an account of his or her progress in the chosen field of research as well as his/ her research plans for the next 2 years

Recommendations for the complex examination:

- The PhD student should either prepare a Power Point presentation or a 1.5-2-page report that has to be enclosed with the written record of the exam
- The assessment of the student shall be made in writing before the complex examination by the supervisor. The one-page assessment may be sent to the members of the committee before the examination.
- The student shall prepare a written dissertation report before the exam, which may be sent to the members of the committee before the examination.
- The candidate's supervisor cannot be the member of the committee; however, they should be present during the dissertation part of the exam.

Regulations concerning the written record of the complex examination:

Government Decree 87/2015 (IV.9.) on the Implementation of certain provisions of Act CCIV of 2011:

(4) 110 The written record of the complex examination shall contain:

- a. the name and institutional ID of the higher education institution
- b. the name, student ID, previous qualification(s) and degree(s) of the candidate
- c. the name and faculty ID of the thesis supervisor
- d. the discipline and the disciplinary area of the doctoral degree
- e. the subjects of the theoretical part, questions asked and evaluation of the responses
- f. the result of the complex examination
- g. the name, faculty ID and signature of the chair and other members of the examination committee

FORMAL REQUIREMENTS OF THE DOCTORAL DISSERTATION:

The dissertation has to be written and submitted in English. The length of the dissertation including figures, graphs, tables and references may not exceed 50 pages. The dissertation has to be printed (character type Time 12, line spacing at 1.5, type-area 16 x 23) and bound before submission.

The front page must include the title of the dissertation, the “PhD thesis” or “Doctoral thesis” designation, the author’s name and the year of submission.

The inner title page must include the title of the dissertation, the names of the author, supervisor and co-supervisor (if appropriate), the place and the date of the dissertation and the name of the Doctoral School. The next page shall include a list of scientific papers that cover the same topic as the dissertation. The items of the list shall be numbered by using Roman numerals. The structure of the dissertation shall correspond to the professional requirements of scientific publications. The individual sections (Introduction, Methods and Materials, Results, Discussion, Conclusion, Acknowledgements, References) of the dissertation shall be proportionate. The system of citations shall correspond to the citation system commonly used in the given field.

A summary of the dissertation has to be enclosed with the thesis, both in English and Hungarian.

The copies of all the candidate's relevant publications (already published or accepted for publication) have to be included in the Appendix.

The dissertation has to be submitted in 5 copies together with a 10-15-page thesis booklet (summary of the dissertation), which has to be written both in Hungarian and in English and submitted in 15 copies in both languages. Every candidate has to send an electronic version (pdf format) of the entire dissertation and the Hungarian and English thesis booklet to the Doctoral School.

Every candidate has to upload the entire dissertation together with the thesis booklet on the SZTE Doktori Repozitórium operated by Library Klebelsberg while, at the same time, submitting them to the Dean's Office. The evaluation of the dissertation may not start before the dissertation has been submitted and uploaded.

When the defence of the thesis is announced, the relevant Faculty or Doctoral School or PhD Secretariat uploads the names of the thesis defence board members into the Repository. The names of the thesis defence board members shall be displayed on the invitation for public disputation.

APPENDICES

Appendix 1.

Regulations governing Doctoral Training programs at the University of Szeged (26 June, 2017)

MANAGING CREDIT POINTS IN THE DOCTORAL TRAINING PROGRAMME

1. During the doctoral training all learning outcomes shall be measured in credits (study credit points). Credits shall be granted for only those study activities that are graded on a 3-level or 5 level grading scale system.
2. During the 48-month-long training period – divided into 8 examination periods – a total of 240 credit points shall be earned to be eligible for a completion of studies certificate.
3. At least 20 and at most 45 credit points shall be collected during each examination period.
4. If a student participates in a partial study at a foreign or other Hungarian university, the relevant Doctoral School Council may grant exemption from the above-mentioned requirements. The credit point value of the courses that had been completed at a foreign or other Hungarian university shall be judged by the relevant Doctoral School Council.
5. With research work such as bibliography, library and archives research, follow-up on journal articles, conference participation – where the student presents a poster or holds a lecture – and publishing articles in journals a total of at least 130 credit points shall be achieved.
6. The credit point value of the theoretical course with two lessons per week (14 weeks/semester) shall be 3-6 points. The credit point value shall change in proportion with the change in the total number of lessons i.e. taking an intensive course with an external lecturer. At least 5 theoretical courses of 2 classes/week have to be completed by the students.
7. For the pre-degree certificate that states that all courses have been covered at least 15 credits points shall be achieved from the theoretical courses.
8. The credit point value of the weekly one lesson per week (for 14 weeks) practical session (seminar) shall be 1-2 credit points. With teaching activities 48 credit points shall be achieved at the most; 8 credit points per semester at the most. No credit points shall be granted for lessons that the PhD student is paid for.
9. Should the school set it as a requirement that, at certain intervals, during departmental or research group seminars, the PhD student shall give an account of his research activities then one such report may worth 3-5 credit points. It is recommended to require at least one such report (in the sixth examination period, for example). The Doctoral School Council shall determine the number of reports to be recognised with credit points.
10. PhD students may be granted credit points for journal articles and active conference participation with lectures and posters if they are published in the conference publications. The credit point value of the above-mentioned activities shall depend on the students' level of contribution to the achieved outcomes. With the consent of the relevant Disciplinary Doctoral Council (DDC) and Doctoral Council of the relevant Branch of Science, such credits shall be determined by the relevant Doctoral School Council.

Government decree Section 11 (2) For medical residents and medical in-house practitioners—who are participating in a particular training programme to ensure the succession of academic tutors at medical higher education institutions—out of their completed core training modules and professional practice period, the relevant Credit Transfer Committee—in pursuant of the doctoral regulations—shall only permit the recognition of two semesters or sixty credit points.

11. With the consent of the relevant DDC, recognition of credit points – in pursuant of the Government Decree – shall be decided by the Doctoral School Council. Such recognition shall only be possible with PhD students in the organised training programme.
12. The credit points recognised on the basis of the previous section shall be confirmed by the head of the Doctoral School, and the acquisition of the training credit points shall be confirmed by the lecturer of the theoretical course. The Doctoral School Council shall determine the credit points to be confirmed by the head of the training/research programme. The supervisor shall be responsible for the confirmation of the remainder of the credit points.
13. Countersigned by the Chair of the DDC, the completion of each study period shall be certified by the Dean for Research Affairs at the Faculty in the relevant branch of science.

Molecular Cell Biology
Complex Exam Topics for PhD students
2024

1. Cellular regulation, the role of formins in actin and microtubule cytoskeleton regulation
2. Zinc-finger nucleases (ZFNs)TALEN, and CRISPR/Cas-based methods for genome engineering
3. Fluorescent microscope techniques
4. Mammalian artificial chromosomes in gene-based cell therapy
5. Chromosome / genome stability
6. Regulation of cell division: role of protein degradation and phosphorus regulation
7. DNA repair mechanisms
8. Autophagy

Biochemistry
Complex Exam Topics for PhD students
2024

1. Structure of proteins and methods of protein structure analysis
2. Function and methods of protein function analysis, proteomics, enzymology
3. Structure, types and function of nucleic acids
4. Nucleic acid Research methods, genomics, transcriptomics
5. Regulation of metabolic processes, test methods
6. Bioenergetics, metabolomics
7. Possibilities and limitations of molecular-based drug development
8. Information transmission systems and research methods of biological signal transduction

Recommended
reading list:

Lehninger: Principles of Biochemistry (David L. Nelson, Michael M. Cox) 7.kiadás 2017

Paul R. Graves and Timothy A. J. Haystead: Molecular Biologist's Guide to Proteomics, MICROBIOLOGY AND MOLECULAR BIOLOGY REVIEWS, Mar. 2002, p. 39–63

Fabian Hosp and Matthias Mann, A Primer on Concepts and Applications of Proteomics in Neuroscience, Neuron 86, 558-571, 2017

September 1, 2024.

Prof. Dr. Norbert László Jost
Head of Doctoral School