



TRAINING PLAN

Biophysics Program

Doctoral School of Molecular Medicine

University of Debrecen



<https://modi.unideb.hu>
<https://biophys.med.unideb.hu>

CREDIT REQUIREMENTS

- 240 credit points are required
 - research (27 credit points for 8 semesters, i.e., 8×27).....216
 - dissertation 6
 - other credits..... 18
 - teaching (max. 3 credits)
 - student supervision, conference participation (max. 3 credits)
 - courses (12-18 credits, to be collected during the first 2 years of the program)

OBLIGATORY COURSES

1. Biophysics for Life Sciences

- Available in the 1st semester of every academic year
- Curriculum: The following 18 topics from the lecture course for medical/molecular biology students:
 - Introduction. Electromagnetic waves, the properties of light (interference, photoelectric effect, photon theory). Matter waves. Thermal radiation.
 - Sedimentation and electrophoresis. Mass spectrometry.
 - Molecular spectra, Jablonski diagram, fluorescence, fluorescence applications.
 - Generation and absorption of X-ray, X-ray crystallography.
 - Optics, optical microscopy, electron microscopy
 - Lasers and their application in biology and medicine.
 - Nuclear physics. Nuclear binding energy, radioactivity, law of radioactive decay, radioactive series.
 - Features of nuclear radiation and its interaction with absorbing material. Detection of radiation.
 - Radiation biophysics: target theory, direct and indirect action of radiation. Dosimetry. Biological effects of radiation.
 - Experimental and diagnostic application of isotopes. Accelerators.
 - Basic principles of nuclear magnetic resonance, NMR spectroscopy in biology and medicine.
 - Chemical potential. Brownian motion. Diffusion at the molecular level, statistical interpretation. Fick's laws. Osmosis.
 - The structure of biological membranes. Membrane transport.
 - Thermodynamic equilibrium potentials (Nernst, Donnan). Diffusion potential, Goldman-Hodgkin-Katz equation.

- Ion channels (gating, selectivity), the "patch clamp" technique.
- Resting potential, action potential, and electrical excitability. Measurement of membrane potential.
- Flow cytometry. Confocal laser scanning microscopy.
- Modern microscopic techniques (atomic force microscopy, super resolution microscopy).
- Attendance at the seminars is not required.
- Exam: Written. Due to differences in the curriculum, the test will be different from those the medical/dentistry/molecular biology students write.
- Credit: 2

2. Cell Biology Lecture Course

- Available in the 2nd semester of every academic year
- Curriculum: All topics from the lecture course for medical students.
- Attendance at the seminars is not required.
- Exam: Written, the test will be different from those the medical/dentistry/molecular biology students write
- Credit: 3

3. Basic Concepts of Biostatistics

- Available in the 1st semester of every academic year
- Curriculum: All topics from the course for medical students supplemented with the following four classes to be held separately:
 - Multiple comparisons, ANOVA
 - Linear regression, correlation and fitting
 - Doing statistics in Excel (two classes with hands-on training)
- Attendance at the seminars is required.
- Exam: Written, the test will be different from those the medical/dentistry/molecular biology students write
- Credit: 3

4. General Research Methods

- Available every academic year
- Exam: online test
- Credit: 1

5. Lecturing, Grant and Paper Writing

- Available in the second semester of every academic year
 - Further details: to be announced later
- In courses 1-3 (Biophysics for Life Sciences, Cell Biology Lecture Course, Basic Concepts of Biostatistics)
 - students who completed one or more of the courses in their previous studies are exempted, and will get the credit without taking the course or the exam
 - the exam consists of one part, i.e. it is not required to pass a minimum requirement tier first
 - one exam day, announced at the beginning of the semester, will be available for A-chance exams, which will be on separate days for those courses available in the same semester; further exam days will be announced for B- and C-chance exams if required
 - Grading:
 - $60\% > \text{score} \geq 50\%$ – pass
 - $70\% > \text{score} \geq 60\%$ – satisfactory
 - $80\% > \text{score} \geq 70\%$ – good
 - $\text{score} \geq 80\%$ – excellentFull credit is obtained for any passing grade.
 - Grade-offering, exemption and mid-semester, self-control tests for bonus points will not be available for PhD students.

OPTIONAL, SUGGESTED COURSES

These courses are available once every two years so that PhD students have a chance to register for them during the first two years of their PhD training. These are only suggested courses, other ones can also be chosen from the list of available courses.

- **Principles and Applications of Digital Image Analysis**
- **MATLAB for All Beginners**
- **Studying Protein-Protein Interactions**

