

# BIOPHYSICS

## Pharmacy

### Division of Biophysics

Subject: BIOPHYSICS

Year, Semester: 1st year/2nd semester

Number of teaching hours:

Lecture: 14

Seminar: 13

Practical: 15

#### 1st week:

Lecture: Introduction to the course. Generation and absorption of X-rays. X-ray contrast materials.

#### 2nd week:

Lecture: Fluorescence spectroscopy, fluorescence techniques.

#### 3rd week:

Lecture: Lasers and their biomedical applications. Photodynamic therapy.  
Practical: Introduction.

#### 4th week:

Lecture: Optical and electron microscopy.  
Seminar: S1: Biostatistics. Set theory. Random events. Conditional probability, marginalization. Independent events. Descriptive statistics. The measure of center and spread.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system For subgroup assignment, please see your lab teacher. P1: Measurement of nuclear radiation P2: Spectrofluorimetry P3: Determination of diffusion constant P4: Refractometry P5: Light microscopy Optical measurements

#### 5th week:

Lecture: Ionizing radiations and their interaction with materials. Dosimetry, tissue effects, detection of radiation.  
Seminar: S2: Biostatistics. Random variables. Distribution function and cumulative distribution function of the random variable. Discrete probability distributions: binomial and Poisson-

distribution.

#### 6th week:

Lecture: Research, diagnostic and therapeutic application of stable and radioactive isotopes. Contrast materials, radiopharmaceutical.  
Seminar: S3: Biostatistics. Continuous random variables; probability density function. Normal and standard normal distribution. Statistical design and analysis; sampling, estimation. Central limit theorem.  
Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

#### 7th week:

Lecture: Medical imaging (CT, PET, SPECT, MRI)  
Seminar: S4: Biostatistics. Hypothesis testing. Null hypothesis. Statistical significance. One- and two tailed tests. The z-test. One sample t-test.  
Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

#### 8th week:

Lecture: Diffusion at the molecular level, statistical interpretation. Fick's 1st law. Thermodiffusion. Osmosis  
Seminar: S5: Biostatistics. Paired t-test. F-test. Unpaired t-test.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

#### 9th week:

Lecture: Structure of biological membranes.

Membrane transport.

Seminar: S6: Biostatistics. Conditional probability in medicine, screening tests. ROC curve. Epidemiologic investigations: odds ratio and relative risk. The Kaplan-Meier curve.

Practical: Practices are performed in subgroups of 4-5 students in a rotary system.

**10th week:**

Lecture: Pharmacology of ion channels (gating, selectivity). Patch clamp technique.

**11th week:**

Lecture: Origin of membrane potential Resting potential, action potential, electric excitability.

Practical: Practical exam

**Reading materials:**

Biophysics laboratory manual.  
Department of Biophysics and Cell Biology,  
2001.

Wayne W. Daniel: Biosatistics: a foundation for  
analysis in the health sciences.

7th edition. John Wiley and Sons, New York,  
1991. ISBN: 0-471-52988-5.

M. Shinitzky: Biomembranes. Physical aspects.  
Vch. Weinheim, 1993. ISBN: 3-527-3021-x.

**12th week:**

Lecture: Fluid mechanics, blood circulation.  
Newtonian fluids, viscosity, creams and  
emulsions.

**13th week:**

Lecture: Methods of pharmacological research.  
Gelelectrophoresis, isoelectric focussing, blotting.  
Detecting molecular interactions (SPR, FCS,  
FRET)

**14th week:**

Lecture: Biophysics of drug delivery.  
Nanotechnology approaches.

Edited by János Szöllősi: Medical Biophysics.  
Medicina, 2009.

Materials.

URL: [www.biophys.dote.hu](http://www.biophys.dote.hu)

Textbook online.

URL:

<http://www.biophysics.org/education/resources.htm>

## Requirements

### Compulsory reading:

Lecture materials and description of lab practical (published on the web page of the Department).  
Medical Biophysics (Editors.: S. Damjanovich, J. Fidy, J. Szöllösi, Medicina, Budapest, 2009, ISBN: 978-963-226-127-0)

### Condition for signing the lecture book:

- All labs have done (if one missed, only one repetition option is available)
- Lab exam attended (no make-up is available)
- Minimally 5 out of 6 biostatistics seminars attended (no make-up is available)
- Signing up for the electronic course PHARM-Biophysics at the exam.unideb.hu website by the end of week 3 (the site can only be reached from inside the University network)
- Lecture attendance is strongly recommended

### Practical requirements

Students write a short quiz (may contain test questions and short calculation problem(s)) before each lab topic. At least 50% must be earned in this test to be eligible for doing the lab. Students failing the quiz need to repeat it then do the practicals within the frame of spare practicals. In the laboratory practical, a laboratory logbook (into a booklet with stable pages) should be written to make the conditions of the measurements accomplished repeatable according to the notes. Students must be prepared for the lab. One part of this preparation is a summary of the theoretical part of the lab exercises to be performed. Each lab is graded from 1 to 5. The average score of 4 or 5 of all labs is rewarded with a +1 exam point. That is added to the laboratory practical exam result. In case of unpreparedness, the lab exercise should be repeated, where a maximum of 2 points can be obtained for the make-up lab. An immediate organization of the make-up lab is the student's responsibility by obtaining written permission from the tutor at the end of the logbook.

### Exams and grading:

- Lab exam (see the actual timetable) – 10+1 points max
- Final exam in biostatistics (see the actual timetable) – 20 points max
- Exemption test (electronic) in biophysics, or written exam (electronic) in the final exam - 70 points max

Total: 100 points.

### Grades:

- 50 < pass (2)
- 60 < satisfactory (3)
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70< good (4)

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80< excellent (5)

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Please note that lab and biostatistics work during the semester constitutes a compulsory part of the final score, which cannot be changed during the exam period, so take your studies seriously throughout the semester.

#### Repeaters

The signature obtained for the subject earlier is making students exempted from attending labs and biostatistics seminars.

Exempted students can choose to keep their scores from last year or to take the exams together with the rest of the class during the semester. Exemption-related decisions must be made before the end of the 3rd week of education, and the study advisor at [biophysedu@med.unideb.hu](mailto:biophysedu@med.unideb.hu) notified about it. In the absence of written notification, we automatically assume that the last year's score is kept, and no further changes will be possible later. Biostatistics and Lab exemptions, scores, exams are independent of each other.