BULLETIN

UNIVERSITY OF DEBRECEN

ACADEMIC YEAR 2019/2020

MSc in Molecular Biology

FACULTY OF MEDICINE

Coordinating Center for International Education

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CHAPTER 1
INTRODUCTION

The aim of the University of Debrecen is to become a university of medical sciences committed to the prevention and restoration of health of the people, not only in its region but in the entire country.

In the past two decades both medical science and health care have entered a new era: the medical science of the 21st century. Molecular medicine is opening up and new possibilities are available for the diagnosis, prevention, prediction and treatment of the diseases. One can witness such a progress in medical sciences that has never been seen before. Modern attitudes in health care should be enforced in practice, including therapeutical approaches that consider the explanation and possible prevention of diseases, and attempt to comprehend and take the human personality into consideration. These approaches demand the application of the most modern techniques in all fields of the medical education.

All curricula wish to meet the challenges of modern times and they embody some very basic values. They are comprehensive; they take into consideration the whole human personality (body and soul) in its natural and social surroundings; and they are based upon the best European humanistic traditions. Moreover, all curricula prepare students for co-operation and teamwork.

With respect to education, both students and teachers are inspired to acquire higher levels of professionalism, precision, and problem solving skills, upon which the foundations of specialist training and independent medical practice can be built. This approach enables the assimilation of new scientific developments, facilitating further education and the continuous expansion of knowledge. The interplay of these factors ensures the ability to understand and handle the changing demands of health care.

With respect to research, the faculty members continuously acquire, internalize and subsume new knowledge, especially concerning the genesis, possible prevention and treatment of diseases. Moreover, new information aimed at improving, preserving and restoring the health of the society is also absorbed. The University of Debrecen is already internationally recognized in the fields of both basic and clinical research, and the clinicians and scientists of the University are determined to preserve this achievement. Special attention is given to facilitate and support the close co-operation of researchers representing basic science and clinical research, and/or interdisciplinary studies.

With respect to therapeutic practice, the main objective is to provide high quality, effective, up to date and much devoted health care to all members of the society, showing an example for other medical institutions in Hungary. One of the primary tasks is to continuously improve the actual standards of the diagnostic and therapeutic procedures and techniques, and to establish regional or even nationwide protocols.

With respect to serving the community, all faculty members wish to play a central role in shaping the policies of the health service; both within the region and in Hungary. They also want to ensure that sufficient number of medical doctors, dentists and other health care experts with university education is provided for the society.

With respect to the development, all employees strive for reinforcing those features and skills of the lecturers, scientists, medical doctors, health care professionals, collaborators and students which are of vital importance in meeting the challenges of medical education, research and therapy of the 21st century. These include humanity, empathy, social sensitivity, team-spirit, creativity, professionalism, independence, critical and innovative thinking, co-operation and management.

The organizational structure, including the multi-faculty construction of the institution, is a constantly improving, colorful educational environment, in which co-operation is manifest between the individual faculties and colleges, the various postgraduate programs as well as the molecular-

and medical biology educations.

HIGHER EDUCATION IN DEBRECEN
A Brief History
1235: First reference to the town of Debrecen in ancient charters.
1538: Establishment of the “College of Reformed Church” in Debrecen.
1567: Higher education begins in the College.
1693: Declaration of Debrecen as a “free royal town”.
1849: Debrecen serves as the capital of Hungary for 4 months.
1912: Establishment of the State University of Debrecen comprising the Faculties of Arts, Law, Medicine and Theology.
1918: Inauguration of the Main Building of the Medical Faculty by King Charles IV of Hungary.
1921: The Medical Faculty becomes operational.
1932: Completion of buildings of the campus.
1944: Although during the Second World War, Debrecen became the capital of Hungary again (for 100 days), the University itself is abandoned for a while.
1949: The only year when the University has five faculties.
1950: The Faculty of Law idles; the Faculty of Science is established.
1951: The University is split up into three independent organizations: Academy of Theology, Medical School, Lajos Kossuth University of Arts and Sciences.
1991: The “Debrecen Universitas Association” is established.
1998: The “Federation of Debrecen Universities” is founded.
2000. The federation is transformed into the unified “University of Debrecen” with all the relevant faculties and with some 20,000 students.

Debrecen is the traditional economic and cultural center of Eastern Hungary. In the 16th century Debrecen became the center of the Reformed Church in Hungary and later it was referred to as the "Calvinist Rome". The 17th century was regarded as the golden age of the city because Debrecen became the mediator between the three parts of Hungary: the part under Turkish occupation, the Kingdom of Hungary and the Principality of Transylvania. For short periods of time, Debrecen served twice as the capital of Hungary. Nowadays, with its population of approximately a quarter of a million, it is the second largest city in Hungary.
Debrecen is a unique city: although it has no mountains and rivers, its natural environment is rather interesting. One of the main attractions and places of natural uniqueness in Hungary is Hortobágy National Park, known as “puszta" (“plain”), which begins just in the outskirts of Debrecen. This is the authentic Hungarian Plain without any notable elevations, with unique flora and fauna, natural phenomena (e.g. the Fata Morgana), and ancient animal husbandry traditions. The region is unmatched in Europe, no matter whether one considers its natural endowments or its historic and ethnographic traditions. A very lovely part of Debrecen is the “Nagyerdő” (“The Great Forest”), which is a popular holiday resort. Besides a number of cultural and tourist establishments, luxurious thermal baths and spas, Nagyerdő accommodates the University campus too.
The history of higher education in Debrecen goes back to the 16th century when the College of the Reformed Church was established. The University Medical School of Debrecen has its roots in this spiritual heritage. It was in the year of the millennium of the establishment of Hungary (1896) when the foundation of the present University was decided. The University of Debrecen was established in 1912, initially having four faculties (Faculties of Arts, Law, Medicine and Theology). The University was officially inaugurated by King Charles IV of Hungary on October 23rd, 1918.
The educational activity at the University started in 1924, although the construction of the whole University was completed only in 1932. In 1951 the Faculty of Medicine became a self-contained,

independent Medical University for training medical doctors.
The special training of dentists began in 1976. As a further development the University Medical School established the Health College of Nyíregyháza in 1991. In 1993, as part of a nationwide program, the University was given the rights to issue scientific qualifications and new Ph.D. programs were also launched. Several new programs (e.g. the training of molecular biologists, pharmacists, general practitioners) were commenced in the '90s. The Faculty of Public Health was established in 1999, while the Faculty of Dentistry was founded in 2000.
The Faculty of Medicine celebrated the 90th anniversary of its foundation in October 2008 with a highly successful international scientific conference.

Education at the University of Debrecen
Debrecen, the second largest city of Hungary, is situated in Eastern Hungary. Students enrolled in the various programs (e.g. Medicine, Dentistry, Pharmacy, Public Health, Molecular Biology, etc.) study on a beautiful campus situated in the area called "Great Forest".
The Hungarian Government gives major priorities to the higher education of health sciences in its higher education policy. One of these priorities is to increase the ratio of college level training forms within the Hungarian higher education system. The governmental policy wishes to implement conditions in which the whole health science education system is built vertically from the lowest (post-secondary or certificate) to the highest (PhD-training) levels. In fact, this governmental policy was the reason behind the establishment of the new Health Science Education Center within the Federation of Debrecen Universities (DESZ), based partially on the intellectual resources of the University of Debrecen. The new programs – with specialized training for paramedics – will help to correct the balance of the Hungarian labor-market that became rather unsettled in the past few decades.
The Act of Higher Education (1993) has restored the rights of the medical universities to award postgraduate degrees and residency, and permission was also given to license Physicians' procedures. This kind of training required a new structure, a new administrative apparatus, and a suitable training center. The new residency programs were commenced in 1999.
The introduction of the credit system, starting in September 2003, has been mandatory in every Hungarian university, helping the quantitative and qualitative evaluation of the students' achievements. Admission requirements for Hungarian students are defined at national level, and they are applicable for every student wishing to be enrolled into the Medicine or Dentistry programs.
International students must pass an entrance exam in biology and (depending on their preference) in physics or chemistry. In some special cases it may be possible for the candidates to apply for transfer to higher years on the basis of their previous studies and achievements. International students study in English language. Entrance for certain courses of the Health College is also possible on the basis of a special evaluation (scoring) and an entrance interview.
The syllabuses and classes of all courses correspond to European standards. The total number of contact hours in medical education is over 5,500, which can be divided into three main parts: basic theoretical training (1st and 2nd year), pre-clinical subjects (3rd year) and clinical subjects (4th and 5th year) followed by the internship (6th year). The proportion of the theoretical and practical classes is 30% to 70%; whereas the students/instructors ratio is about 8/1. The first two years of dentistry education are similar to the medicine program, but the former contains a basic dental training that is followed by a three-year-long pre-clinical and clinical training. Besides the medicine and dentistry programs, there are several other courses also available, including molecular biology. The various Health College courses include more and more new curricula.
The Medicine program delivered in English and intended for international students was commenced in 1987; whereas the Dentistry and Pharmacy programs for international students started in 2000

and 2004, respectively. The curriculum of the English language Medicine program meets all the requirements prescribed by the European medical curriculum, which was outlined in 1993 by the Association of Medical Schools in Europe. Compared to the Hungarian program, the most important differences are:
-Hungarian language is taught,
-More emphasis is laid upon the tropical infectious diseases (as parts of the "Internal Medicine" and "Hygiene and Epidemiology" courses).
Otherwise, the English language curriculum is identical with the Hungarian one. The 6th year of the curriculum is the internship that includes Internal Medicine, Pediatrics, Surgery, Obstetrics and Gynecology, Neurology, and Psychiatry. The completion of these subjects takes at least 47 weeks, although students are allowed to finish them within a 24-month-long period. The successfully completed internship is followed by the Hungarian National Board Examination. Just like the rest of the courses, the internship is also identical in the Hungarian and English programs.
A one-year-long premedical (Basic Medicine) course, which serves as a foundation year, is recommended for those applicants who do not possess sufficient knowledge in Biology, Physics and Chemistry after finishing high school.
After graduation, several interesting topics are offered for PhD training, which lasts for three years. If interested, outstanding graduates of the English General Medicine and Dentistry programs may join these PhD courses ("English PhD-program"). Special education for general practitioners has been recently started and a new system is in preparation now for the training of licensed physicians in Debrecen.

The accredited PhD programs include the following topics:
-Molecular and Cell Biology; Mechanisms of Signal Transduction
-Microbiology and Pharmacology
-Biophysics
-Physiology-Neurobiology
-Experimental and Clinical Investigations in Hematology and Hemostasis
-Epidemiological and Clinical Epidemiological Studies
-Cellular- and Molecular Biology: Study of the Activity of Cells and Tissues under Healthy and Pathological Conditions
-Immunology
-Experimental and Clinical Oncology
-Public Health
-Preventive Medicine
-Dental Research

The PhD-programs are led by more than 100 accredited, highly qualified coordinators and tutors.

Medical Activity at the Faculty of Medicine
The Faculty of Medicine is not only the second largest medical school in Hungary, but it is also one of the largest Hungarian hospitals, consisting of 35 departments; including 21 different clinical departments with more than 1,800 beds. It is not only the best-equipped institution in the area but it also represents the most important health care facility for the day-to-day medical care in its region.
The Kenézy Gyula County Hospital (with some 1,400 beds) is strongly affiliated with the University of Debrecen and plays an important role in teaching the practical aspects of medicine. There are also close contacts between the University and other health care institutions, mainly (but not exclusively) in its closer region. The University of Debrecen has a Teaching Hospital Network consisting of 26 hospitals in Israel, Japan and South Korea.

It is also of importance that the University of Debrecen has a particularly fruitful collaboration with the Nuclear Research Institute of the Hungarian Academy of Sciences in Debrecen, allowing the coordination of all activities that involve the use of their cyclotron in conjunction with various diagnostic and therapeutic procedures (e.g. Positron Emission Tomography 'PET').

Scientific Research at the Faculty of Medicine

Scientific research is performed both at the departments for basic sciences and at the laboratories of clinical departments. The faculty members publish about 600 scientific papers every year in international scientific journals. According to the scientometric data, the Faculty is among the 4 best of the more than 80 Hungarian research institutions and universities. Lots of scientists reach international recognition, exploiting the possibilities provided by local, national and international collaborations. Internationally acknowledged research areas are Biophysics, Biochemistry, Cell Biology, Immunology, Experimental and Clinical Oncology, Hematology, Neurobiology, Molecular Biology, Neurology, and Physiology. The scientific exchange program involves numerous foreign universities and a large proportion of the faculty members are actively involved in programs that absorb foreign connections (the most important international collaborators are from Belgium, France, Germany, Italy, Japan, the UK and the USA).

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PhD Student		Gergő Veres
Clinical Assistant	Ms.	Melinda Bán M.D.
	Ms.	Veronika Deczkiné Gaál M.D.
	Ms.	Zsuzsanna Ferenczi M.D.
	Ms.	Zsófia Fülesdi M.D.
	Ms.	Edina Kósik M.D.
		Ádám Leskó M.D.
		Tamás Papp M.D., Ph.D.
		Attila Mátyás Petró M.D.
		Máté Sik M.D.
	Ms.	Zsuzsanna Erzsébet Szabó M.D.
	Ms.	Orsolya Szalmás M.D.
	Ms.	Anita Tresó M.D.
	Ms.	Enikő Verebi M.D.
Resident	Ms.	Ivett Deák M.D.
		Kázmér Kovács M.D.
		Márton Oláh M.D.
		Bence Gábor Papp M.D.
		Bence Pelyvás M.D.
		Mustafa Sayed-Ahmad M.D.
	Ms.	Annamária Silye M.D.
	Ms.	Nikoletta Vasas M.D.
Molecular Biologist	Ms.	Eszter László
Academic Advisor	Ms.	Éva Pásztor M.D.

CHAPTER 6
OTHER DEPARTMENTS

DEPARTMENT OF BOTANY

Egyetem tér 1., Debrecen, 4032, Tel: +36-52-512-900

Full Professor, Head of Department		Gábor Vasas M.Sc., Ph.D., D.Sc.
Full Professor		György Borbély M.Sc., D.Sc.
		Attila Molnár V. M.Sc., Ph.D., D.Sc.
Associate Professor	Ms.	Márta M-Hamvas M.Sc., Ph.D.
		Csaba Máthé M.Sc., Ph.D.
		Gábor Matus M.Sc., Ph.D.
	Ms.	Ilona Mészáros M.Sc., Ph.D., C.Sc.
Senior Research Fellow		János Kerékgyártó M.Sc., Ph.D., C.Sc.
Assistant Professor		Sándor Gonda D.Pharm., M.Sc., Ph.D.
		Viktor Oláh M.Sc., Ph.D.
		Gyula Surányi M.Sc., C.Sc.

DEPARTMENT OF GENETICS AND APPLIED MICROBIOLOGY

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Full Professor		Mátyás Sipiczky M.D., Ph.D., D.Sc.
Senior Assistant Professor	Ms.	Zsuzsa Antunovics Ph.D.
Assistant Professor	Ms.	Terézia Barna Ph.D.
	Ms.	Hajnalka Csoma Ph.D.
PhD Student		László Elek J.D.
	Ms.	Enikő Horváth
		Zoltán Kállai
	Ms.	Edina Karanyicz
	Ms.	Erika Papp M.D.
		László Papp
		Walter Pfliegler

INSTITUTE OF BIOLOGY AND ECOLOGY

Egyetem tér 1., Debrecen, 4032, Tel: +3652-512-900

Head of Institute	Béla Tóthmérész Ph.D., D.Sc.

Department of Ecology

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Senior Research Fellow	Zoltán Szurmai Ph.D.
Assistant Professor	Roland Horváth M.Sc., Ph.D.
	Ms. Ibolya Márkóczi M.Sc., Ph.D.
	Ms. Edina Simon M.Sc., Ph.D.
	Péter Török M.D., Ph.D.
	Ms. Orsolya Valkó M.Sc., Ph.D.
Assistant Lecturer	István Gyulai M.Sc.
Invited Lecturer	Gábor Lövei M.Sc., Ph.D., D.Sc.

INSTITUTE OF CHEMISTRY

Egyetem tér 1., Debrecen, 4032, Tel: +3652512900

Head of Institute	Ms. Katalin Várnagy M.Sc., Ph.D., D.Sc.

Department of Inorganic and Analytical Chemistry

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Full Professor	Ms. Katalin Erdődi-Kövér M.Sc., Ph.D., D.Sc., M.H.A.Sc.
	István Fábián M.Sc., Ph.D., D.Sc.
	Ms. Katalin Várnagy M.Sc., Ph.D., D.Sc.
Professor Emeritus	Ernő Brücher Ph.D.,D.Sc.,M.Sc.
	Ms. Etelka Farkas M.Sc., Ph.D., D.Sc.
	Imre Sóvágó M.Sc., Ph.D., D.Sc.
Associate Professor	Péter Buglyó M.Sc., Ph.D.

	Ms.	Gyöngyi Gyémánt M.Sc., Ph.D.
	Ms.	Csilla Kállay M.Sc., Ph.D.
		István Lázár M.Sc., Ph.D.
Assistant Professor	Ms.	Edina Baranyai M.Sc., Ph.D.
	Ms.	Linda Földi-Bíró M.Sc., Ph.D.
		József Kalmár M.Sc., Ph.D.
	Ms.	Melinda Pokoraczkiné Andrási M.Sc., Ph.D.
	Ms.	István Timári M.Sc., Ph.D.
Research Fellow	Ms.	Ágnes Dávid M.Sc., Ph.D.
	Ms.	Krisztina Fehér M.Sc., Ph.D.
	Ms.	Attila Forgács M.Sc., Ph.D.
		Tamás Gyöngyösi M.Sc.
	Ms.	Ágnes Hőgyéné Grenács M.Sc., Ph.D.
		Ádám Kecskeméti M.Sc., Ph.D.
		Norbert Lihi M.Sc., Ph.D.
	Ms.	Annamária Sebestyén M.Sc., Ph.D.
Academic Advisor	Ms.	Annamária Sebestyén M.Sc., Ph.D.

Department of Organic Chemistry
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Full Professor, Head of Department		Tibor Kurtán Ph.D., D.Sc.
Full Professor		Sándor Antus Ph.D., D.Sc.
		Gyula Batta Ph.D., D.Sc.
		Tibor Kurtán Ph.D., D.Sc.
		László Somsák M.Sc., Ph.D., D.Sc.
Associate Professor		László Juhász M.Sc., Ph.D. habil.
		Attila Kiss M.Sc., Ph.D. habil.
		László Lázár Ph.D. habil.
	Ms.	Tóth Marietta Vágvölgyiné M.Sc., Ph.D. habil.
Assistant Professor	Ms.	Éva Bokor M.Sc., Ph.D.
	Ms.	Tóth Éva Juhászné M.Sc., Ph.D.
	Ms.	Krisztina Kónya M.Sc., Ph.D.
		Sándor Kun M.Sc., Ph.D.
	Ms.	Tünde Zita Tóthné Illyés M.Sc., Ph.D.
Academic Advisor	Ms.	Tóth Éva Juhászné M.Sc., Ph.D.

DEENK LIFE SCIENCES LIBRARY

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Director Libraries	Ms.	Gyöngyi Karácsony M.Sc.
Reference Services	Ms.	Edit Görögh M.Sc., Ph.D.
Collection Development Department	Ms.	Katalin Takácsné Bubnó M.Sc.
Education and Research Support Department	Ms.	Judit Éva Fazekas-Paragh M.Sc.

CHAPTER 7
UNIVERSITY CALENDAR

UNIVERSITY CALENDAR for MSc in MOLECULAR BIOLOGY PROGRAM 2019/2020 ACADEMIC YEAR

OPENING CEREMONY: September 8, 2019
GRADUATION CEREMONY: June/July 2020;

1st semester

Year	Course	Examination Period
1st year M.Sc. in Molecular Biology 2nd year M.Sc. in Molecular Biology	September 9 – December 13, 2019 (14 weeks)	December 16, 2019 – January 31, 2020 (7 weeks)

2nd semester

Year	Course	Examination Period
1st year M.Sc. in Molecular Biology	February 10 – May 15, 2020 (14 weeks)	May 18 – July 3, 2020 (7 weeks)
2nd year M.Sc. in Molecular Biology (before graduation)	February 10 – May 1, 2020 (12 weeks)	May 4 – June 12, 2020 (6 weeks)

CHAPTER 8
CREDIT SYSTEM

ACADEMIC PROGRAM FOR CREDIT SYSTEM

The introduction of the credit system became compulsory in every Hungarian university, including the University of Debrecen by September, 2003. The aim of the credit system is to ensure that the students' achievements can be properly and objectively evaluated both quantitatively and qualitatively.
A credit is a relative index of cumulative work invested in a compulsory, a required elective or a freely chosen subject listed in the curriculum. The credit value of a course is based upon the number of lectures, seminars and practical classes of the given subject that should be attended or participated in (so called "contact hours"), and upon the amount of work required for studying and preparing for the examination(s). Together with the credit(s) assigned to a particular subject (quantitative index), students are given grades (qualitative index) on passing an exam/course/class. The credit system that has been introduced in Hungary meets the standards of the European Credit Transfer System (ECTS). The introduction of the ECTS promotes student mobility, facilitates more effective organization of students' exchange programs aimed at further education in foreign institutions, and allows recognition of the students' work, studies and achievements completed in various foreign departments by the mother institution. Credit-based training is flexible. It provides a wider range of choice, enables the students to make progress at an individual pace, and it also offers students a chance to study the compulsory or required subjects at a different university, even abroad. Owing to the flexible credit accumulation system, the term "repetition of a year" does not make sense any longer. It should be noted, however, that students do not enjoy perfect freedom in the credit system either, as the system does not allow students to randomly include subjects in their curriculum or mix modules. Since knowledge is based on previous studies, it is imperative that the departments clearly and thoroughly lay down the requirements to be met before students start studying a subject.
The general principles of the credit system are the following:

1.Students can be given their degree if, having met other criteria as well, they have collected 120 credits during their studies. Considering the recommended curriculum, this can be achieved in two years (four semesters).

2.According to the credit regulations, students should obtain an average of 30 credits in each semester.

3.The criterion of obtaining 1 credit is to spend 30 hours (including both contact and non-contact hours) studying the given subject.

4.Credit(s) can only be obtained if students pass the exam of the given subject.

5.Students accumulate the required amount of credits by passing exams on compulsory, required elective and freely chosen subjects. Completion of every single compulsory credit course is one of the essential prerequisites of getting a degree. Courses belonging to the required elective courses are closely related to the basic subjects, but the information provided here is more detailed, and includes material not dealt with in the frame of the compulsory courses. Students do not need to

take all required elective courses, but they should select some of them wisely to accumulate the predetermined amount of credits from this pool. Finally, a certain amount of credits should be obtained by selecting from the freely chosen courses, which are usually not related to the basic (and thus mandatory) subjects, but they offer a different type of knowledge.

6.58, 19, 7 and 6 credits of the total of 120 credits should be accumulated by completing the compulsory, differentiated professional, oriented elective and freely chosen courses, respectively.
The curriculum in English program corresponds with the curriculum in Hungarian program.

7.The students qualified in molecular biology are required to know the principles of biology, to have general knowledge in the fields of natural sciences and to be familiar with the methods of scientific thinking and problem-solving approach.
The competency is based on the content of basic modules and the process of preparation of diploma thesis. Since the target can be reached mainly by collection and evaluation of knowledge, the lectures and seminars are important forms of education.
Besides the acquirement of knowledge, the professionals in molecular biology have to be able to recognize the problems, to elaborate the way of solution, to evaluate and interpret the results. From this respect, the practicals and the laboratory work during the making of diploma thesis offer good possibilities.
Nowadays there is an ever increasing demand for the skills regarding innovative activity, abilities for self-improvement of practical utilization of own results, and organization of individual activity. It can require some type of non-professional (legal, economical, management) knowledge, which can be achieved also by optional courses.
The students graduated in molecular biology master program know the most important results of molecular biology and the possibilities for their application, the approach and methodological tools of molecular biology, the structure and function of the human body to an extent necessary for acquirement of professional knowledge, the bases of genomics, medical immunology and microbiology, and have general knowledge in pharmacology. The differentiated professional subjects assure the acquirement of professional competencies. These subjects are offered in obligatory or oriented elective form. The topics are processed in lectures and practicals, which guarantee the acquirement of competencies. Considering the institutional characteristics and possibilities, it is warranted that in the given fields the highly qualified staff takes part in the education.

8.The pilot curricula show the recommended pacing of compulsory courses. If these courses are carefully supplemented with credits obtained from the necessary number of required elective and freely chosen courses, students can successfully accumulate the credits required for their degree within 4 semesters.

9.The diploma work is worth 30 credits.
The Degree thesis (dissertation) is a paper written about the individual scientific investigations in the field of molecular biology, which proves the profound knowledge of the student. It has to demonstrate, that the student became familiar with the basis of library and literature use as well as is able to formulate and document own opinion in adequate form, and defend the thesis in a debate taken before a professional committee.

10.Regulations concerning the training of students in the credit system prescribe a minimum amount of credits for certain periods as outlined in the Rules and Regulations for English Program Students.

11.Although Physical Education is not recognized by credits, it have to be completed to get the final degree (see the rules outlined in the Information section about the conditions).

12.Evaluation of the students' achievements needed for grants or applications is described in Rules and Regulations for English Program Students.

13.Further information is available in the Rules and Regulations for English Program Students.

We very much hope that the system of training will contribute to the successful completion of your studies.
We wish you good luck with your university studies.

CHAPTER 9
ACADEMIC PROGRAM FOR CREDIT SYSTEM

Compulsory courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Biochemistry of Metabolism	AO_MBE_ACS01	28	14		ESE*	4	None
1	Biophysics	AO_MBE_BIF01	28			ESE	3	None
1	Human Physiology I.	AO_MBE_HET01	28			ESE*	3	None
1	Medical Genome Biology	AO_MBE_MGB01	28		42	ESE*	5	None
1	Methods of Molecular Biology	AO_MBE_MBE01	28			ESE*	3	None
1	Molecular Genetics	AO_MBE_GEN01	28		28	ESE*	4	None
1	Molecular Immunology	AO_MBE_IMM01	28	10		ESE*	3	None
1	Radioisotope Techniques in Biomedicine	AO_MBE_ITE01	28			ESE	3	None
1	Radioisotope Techniques In Biomedicine Practical	AO_MBE_ITG01			14	AW5	1	together with Radioisotope Techniques in Biomedicine

Compulsory courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Bioinformatics	AO_MBE_BIE02	28			ESE	3	None
2	Bioinformatics Practicals	AO_MBE_BIG02			14	AW5	1	together with Bioinformatics
2	Biostatistics	AO_MBE_BST02	14			ESE	1	None
2	Cell and Organ Biochemistry	AO_MBE_CBI02	28	14	14	ESE*	4	Biochemistry of Metabolism
2	Cell Biology	AO_MBE_SBI022	28			ESE*	3	None
2	Human Physiology II.	AO_MBE_HET02	28			ESE*	3	Human Physiology I.
2	Human Physiology Practicals	AO_MBE_HEG02			28	AW5	2	Human Physiology I.; together with Human Physiology II.
2	Methods in Molecular Biology Practicals	AO_MBE_MBG01			46	AW5	2	Methods of Molecular Biology
2	Physiology of Prokaryotes and Molecular Virology	AO_MBE_PRO02	28		14	ESE	4	None
2	Plant Molecular Biology	AO_MBE_NBI02	28	28		ESE	4	None
2	Problem-solving Exercises in Molecular Biology	AO_MBE_PMF02			45	AW5	2	None
2	Thesis project work I.	AO_MB_DD02			70	AW5	5	None

Compulsory courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Thesis project work II.	AO_MB_DD03			150	AW5	10	Thesis I.

Compulsory courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Thesis project work III.	AO_MB_DD04			210	AW5	15	Thesis II.

M.Sc. In Molecular Biology – Specialization Module in Biochemistry-Genomics

Required elective courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Biochemistry Practical I.	AO_MBE_BKG3			42	AW5	2	None

M.Sc. In Molecular Biology – Specialization Module in Biochemistry-Genomics

Required elective courses for the 1. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Cell Biology Practice	AO_MBE_SBG42			15	AW5	3	together with Cell Biology
2	Proteomics	AO_MBE_PRO04	28		28	ESE	4	None
2	Structure and Function of Macromolecules	AO_MBE_MMS02	14		30	ESE	3	Medical Genom Biology

M.Sc. In Molecular Biology – Specialization Module in Biochemistry-Genomics

Required elective courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
1	Gene Expression Regulation – Functional Genomics	AO_MBE_GES03	14	28		ESE	3	Medical Genom Biology
1	Genomic Bioinformatics	AO_MBE_BGI02	14		28	ESE	3	Medical Genom Biology
1	Introduction to Molecular Medicine	AO_MBE_IMM03	25			ESE	2	None
1	Signalling Pathways in the Cells	AO_MBE_SJF03	28			ESE	3	Cell and Organ Biochemistry

M.Sc. In Molecular Biology – Specialization Module in Biochemistry-Genomics

Required elective courses for the 2. year

Sem	Subjects	Neptun code	L	S	P	Exam	Crd	Prerequisites of taking the subject
2	Enzymology	AO_MBE_ENZ03	10		42	AW5	4	Biochemistry of Metabolism
2	Post-translational Modification of Proteins	AO_MBE_FPT04	28			ESE	3	Cell and Organ Biochemistry

M.Sc. In Molecular Biology – Specialization Module in Biochemistry-Genomics

Freely Chosen Courses for the 2. year

Department	Subject	Neptun code	Crd	Sem	Hours	Exam	Prerequisites of taking the subject	Coordinator
Department of Biochemistry and Molecular Biology	Biochemistry of Apoptosis	AO_MBE_ABI03	3	1	28	ESE	Cell and Organ Biochemistry	Zsuzsa Szondy M.D., Ph.D., D.Sc.
Department of Medical Chemistry	Bioinorganic Chemistry	AO_MBE_BSZ03	3	1	28	ESE	None	Ferenc Erdődi M.Sc., Ph.D., D.Sc.
Division of Cell Biology	Selected Topics in Cell Biology	AO_MB_SCT04	2	2	24	ESE	Cell Biology	György Vereb M.D., Ph.D., D.Sc.

Freely Chosen Courses for the 2. year

Department	Subject	Neptun code	Crd	Sem	Hours	Exam	Prerequisites of taking the subject	Coordinator
Department of Immunology	Impaired Signal Transduction in the Immune System	AO_MBE_ITZ03	2	1	15	ESE	Molecular Immunology	Tamás Bíró M.D., Ph.D., D.Sc.
Department of Immunology	Immunological Methods in Molecular Biology	AO_MBE_IMM02	3	2	30	ESE	Molecular Immunology	Péter Gogolák M.Sc., Ph.D.
Department of Immunology	New System Biology Paradigms in Immunology	AO_MBE_UPI02	3	2	11	ESE	Molecular Immunology	Kitti Pázmándi M.Sc., Ph.D.
Department of Immunology	Basis of Conventional and Biological Immunotherapies	AO_MBE_HBI03	2	2	30	ESE	Impaired Signal Transduction in the Immune System	Árpád Lányi M.Sc., Ph.D.
Department of Medical Imaging	Nobel prize and molecular biology	AO_MBE_NPR03	1	-	14	ESE	None	Teréz Nyesténé Nagy M.D., B.Sc.
Department of Pharmacology and Pharmacotherapy	Introduction to Ayurveda and Integrative Practice of Clinical Medicine I.	AOG24950	2	1	26	AW5	None	
Department of Pharmacology and Pharmacotherapy	Introduction to Ayurveda and Integrative Practice of Clinical Medicine II.	AOG24951	2	2	26	AW5	Introduction to Ayurveda and Integrative Practice of Clinical Medicine I.	
Division of Clinical Physiology	Basics of Molecular Biology and its application	AOG337801	5	1	60	AW5	None	Attila Tóth M.Sc., Ph.D., D.Sc.

CHAPTER 10
ACADEMIC PROGRAM FOR THE 1ST YEAR

Department of Biochemistry and Molecular Biology

Subject: **BIOCHEMISTRY OF METABOLISM**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **14**

1st week:
Lecture: The biology of the mitochondria I. Mitochondrial transport. The processes and regulation of citric acid cycle and oxidative phosphorylation.

2nd week:
Lecture: The biology of the mitochondria II. Oxidative phosphorylation 2. Anaplerotic reactions. The mitochondrial genome - maintenance and mutations.

3rd week:
Lecture: Carbohydrate metabolism I. Basic metabolic pathways, tissue-specific regulation of carbohydrate metabolism.

4th week:
Lecture: Carbohydrate metabolism II. Inherited diseases of carbohydrate metabolism. Biochemistry of diabetes.

5th week:
Lecture: Lipid metabolism I. Transport and processing of lipids in the digestive track and in the circulation. Covalent lipid-protein interactions, lipoprotein complexes. Synthesis and degradation of triacyl glycerols.

6th week:
Lecture: Lipid metabolism II. Metabolic changes during the well-fed state and during starvation. Ketone bodies. The mevalonate pathway. Synthesis of steroid hormones, bile acids, eicosanoids. Lipid peroxidation. Vitamin D metabolism.

7th week:
Lecture: Lipids in health and disease. Cholesterol synthesis, transport, storage and efflux - processes, regulatory mechanisms, drug treatment. The LDL receptor. Obesity and metabolic syndrome.

8th week:
Lecture: Nutrition: Vitamins.
Self Control Test (Topics of week 1-7.)

9th week:
Lecture: Protein structure I. Fundamentals of protein structure, determining the macromolecular structure of proteins. Hierarchy of protein structures, primary, secondary, tertiary, quaternary structures. Characteristics of alpha helices and beta sheets. Schematic representation of secondary structures, topological diagrams.

10th week:
Lecture: Protein structure II. Intrinsically disordered proteins.

11th week:
Lecture: Amino acid metabolism I. Production and utilization of the intracellular amino acid pool. Exogenous and endogenous sources of amino acids. Common reactions of amino acid metabolism: the fate of nitrogen. Production and efflux of ammonia.

12th week:
Lecture: Amino acid metabolism II. Inter-organ nitrogen transport. Processes and regulation of the urea cycle. C1-transfer, transmethylation,

monooxygenation and dioxygenation reactions. Diseases of amino acid metabolism.

13th week:
Lecture: Nucleotide metabolism I. The nucleotide pool. Digestion and absorption of nucleotides. De novo synthesis of purine nucleotides, regulation, salvage reactions.
14th week:
Lecture: Nucleotide metabolism II. De novo synthesis of pyrimidine nucleotides, regulation. Diseases of nucleotide metabolism. Antiviral and antitumor effect of nucleoside analogs.
Self Control Test (Topics of weeks 8-14)

Requirements

Course content:
Topics of metabolism presented at the lectures and discussed during the seminars (lecture slides are available at the https://elearning.med.unideb.hu web site, login with your university network ID and password). At the seminars the lectures of the previous week and new scientific information connected to the lectures will be discussed with the seminar teacher.

Requirements:
Lecture attendance is not compulsory, but recommended. Three absences are accepted from the seminars - in case of more absences students will not be permitted to take the written exam. Absences are accepted for medical reasons, certain family reasons or scientific programs - please provide certificates to the course administrator before the end of the semester.

Self-control tests: (not obligatory) During the semester students may choose to write 2 self-control tests addressing the curriculum of the lectures and seminars. The self-control tests consist of single-choice and multiple-choice test questions, and by writing both tests a total of maximum 100 points can be collected. If the combined score of the tests is above 60% of the total score, grades will be offered based on the score at the end of the semester. If the offered grade is not accepted by the student, a written exam must be taken during the exam period.

Grading: Grades will be offered based on the combined score of the self-control tests, or the score of the written examination during the exam period, based on a five-grade scale.

Test grading:
Pass (grade 2): 60-69 points;
Satisfactory (grade 3): 70-79 points;
Good (grade 4): 80-89 points;
Excellent (grade 5): 90-100 points.

The written exams also consist of single-choice and multiple-choice test questions. Students may take one improvement exam per exam period (for the offered grade or for the written exam).
Please follow the **announcements** of the department about the control tests, exams and other current information on the bulletin board (LSB downstairs, 1 corridor), and on the website (http://bmbi.med.unideb.hu).

Department of Human Genetics

Subject: **MEDICAL GENOME BIOLOGY**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**
Practical: **42**

1st week:
Lecture: Introduction into genomics. Nanotechnology in medicine.
Practical: Introduction.

2nd week:
Lecture: The technology of DNA sequencing. introduction into evolutionary genome biology.
Practical: Introduction to sequence alignment, BLAST

3rd week:
Lecture: Whole genome sequencing. Significance, examples, databases.
Practical: Databases

4th week:
Lecture: Variability of the human genome. New generation sequencing.
Practical: Analysis of gene expression data with the GEO database.

5th week:
Lecture: Biostatistics in global genome analysis.
Practical: Genetics polymorphisms - disease association, using dbSNP, complex diseases.

6th week:
Lecture: Global proteome analysis.
Practical: Introduction to network analysis, PPI networks, using the STRING tool.

7th week:
Lecture: Analysis of protein sequences and structures. Protein databases.
Practical: Complex genetic analysis through an example: kRAS.

8th week:
Lecture: Global analysis of gene expression. (Friday is a holiday, date and time of this week lecture have to be changed.)
Practical: Epigenetics - use of RNAseq data, DNA methylation.

9th week:
Lecture: Gene and proteome profiling in the diagnostics.
Practical: RNA sequencing.

10th week:
Lecture: Applied genome analysis in drug research.
Practical: Exon seq, WHGS, GWAS analysis, database, sequence variant analysis.

11th week:
Lecture: Biomarkers in diagnostics. History of genome science, biotechnology, philosophical aspects.
Practical: Expression analysis in diseases, biological experiments.

12th week:
Lecture: Antibody-based proteomics in cancer diagnostics.
Practical: Phenotypes with complex genetics, disease analysis based on interactive GWAS database analysis.

13th week:
Lecture: Gene maps and polygenic diseases.
Practical: Consultation.

14th week:
Lecture: Integrative biology, genome-scale information. Genomics of complex diseases.
Practical: Short presentations.

Requirements

The program consists of lectures and seminars. Attendance of lectures is important, because the material which is required at the examination is presented here. Therefore, participation on at least 30% of the lectures is compulsory. If the number of absences exceeds 30% of the lectures the signature will be rejected.
Attendance at the seminars is also important. If the student misses more than 2 seminars, he or she will have to take a test ("labtest") to qualify for the signature. If the student has more than 4 absences from the seminars, the signature will be rejected and the semester must be repeated. End of semester examination:
15-20 short essay questions are given to each student.

Grading of the papers is the following:
0-49,99 %: fail (1),
50-59,99 % pass (2),
60-69,99 %: satisfactory (3),
70-79,99 % good (4),
80-100 %: excellent (5).

Academic advisor: Professor László Takács, laszlo.takacs@biosys-intl.com
Course coordinator: Dr. András Penyige, penyige@med.unideb.hu

The slides of the lectures and up-to-date information can be found at https://elearning.med.unideb.hu, username and password is your network-id (same as Neptun-id) and password. You will be able to check the content after the Neptun has registered you to the subject.
Departmental homepage: https://humangenetics.unideb.hu

Subject: **MOLECULAR GENETICS**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**
Practical: **28**

1st week:
Lecture: 1. Introduction into molecular genetics. Organization of genetic material in pro- and eukaryotic cells. 2. Cytogenetics I. Karyogram, ideogram, banding techniques. Human autosomal trisomies.
Practical: Methods of study, required and advised readings. Laboratory safety in the laboratory. Nucleus and chromatin. Cell division.

2nd week:
Lecture: 3. Cytogenetics II. Abnormalities of the X and Y chromosomes. Structural aberrations of human chromosomes. 4. Cytogenetics III. Sex determination in humans. Molecular cytogenetics.
Practical: Cytogenetics. Evaluation of karyograms

3rd week:
Lecture: 5. The function of genes. Gene expression. 6. Genetic code. Translation.
Practical: Gene structure, function (gene, DNS replication, transcription, translation).

4th week:
Lecture: 7. Bacterial genetics. 8. Gene regulation in prokaryotes.
Practical: Gene regulation in prokaryotes. Bacterial genetics.

5th week:
Lecture: 9. The structure of the genes and gene regulation in eukaryotes. The genes of immunglobulines. 10. Epigenetics. Imprinting. Uniparental disomy.
Practical: Gene regulation in eukaryotes.
Self Control Test (1st self-control test in extra time.)

6th week:
Lecture: 11. Repair of the DNA. Mutagenic agents. Ames test. Dinamic mutations. 12. Molecular genetics of the cell cycle.
Practical: Mutation, repair, Ames-test.

7th week:
Lecture: 13. Oncogenetics. 14. Transmission genetics. Genes and alleles. Genotype and phenotype. Monohybrid cross. Mendel's 1st law. Reciprocal cross and test cross. Different types of inheritance.
Practical: Oncogenes and tumorsupressors.

8th week:
Lecture: 15. Genetic polimorhism I. Allelic polymorhism. X-linked genes. 16. Dihybrid cross. Mendel's 2nd law and meiosis. Linked and not-linked genes. Recombination of non-allelic genes. Genetic mapping.
Practical: Problem solving and seminar on mendelian genetics.

9th week:
Lecture: 17. Gene interactions, epistasis, lethal genes. Variations of the gene expression. LOD score. 18. Extranuclear inheritance. Mutations in mitochondrial genes.
Practical: Pedigree analysis. Basic of the human genetics. Seminar on molecular genetics of inherited human diseases.

10th week:
Lecture: 19. Genetic polymorphisms II. Human genetic diversity. Genetics of blood types. 20. Genetic polymorphisms III. Genetics of MHC. DNS-polymorphisms as alleles: RFLP, SNP, micro- és minisatellites. Copy number variations.
Practical: Study of sex chromatin. Demonstration of mammalian chromosomes. Preparation of metaphase spreads.
Self Control Test (2nd self-control test in extra time.)

11th week:
Lecture: 21. The genetic basis of complex inheritance. 22. Genetic polymorphisms IV. Pharmacogenetics, pharmacogenomics. Ecogenetics and ecogenomics.
Practical: Transformation of Escherichia coli. Complementation test. The gene concept.

12th week:
Lecture: 23. Population genetics. Hardy-Weinberg equilibrium. Inbreeding. Genetical basis of evolution. 24. Transposable elements.
Practical: Detection of human DNA polymorphism by polymerase chain reaction.

13th week:
Lecture: 25. The genetic role of RNA. 26. Developmental genetics.
Practical: PCR evaluation of the human polymorphism experiment. Induction of beta-galactosidase in E. coli cells.

14th week:
Lecture: 27. Clinical applications of new biotechnology techniques. 28. Results of Human Genom Project.
Practical: Seminar on population genetics.
Self Control Test (3rd self-control test in extra time.)

Requirements

Conditions of signing the lecture book:

1, Attendance
Concerning attendance, the rules laid out in the EER of the University are clear.

The presence of students at laboratory practices and seminars is obligatory and will be recorded. **Students are responsible for signing the list of attendance.** The professor refuses his/her signature in the student's Lecture Book for the semester's course-work in the case of over four weeks of absence, even if the student has an acceptable excuse.
If the student is absent from more than two practices or seminars (taken together), the semester will be accepted only if they pass an examination based on the material covered by the laboratory classes and seminars of the semester (lab test).
Successful accomplishment of the laboratory practices will be controlled by signing the laboratory notes. If 3 or more practices will not be accepted, the lecture book will not be signed. These students must sit for a written exam from the laboratory material.
The lab notes for the experiments should contain the followings:
Part made at home during the preparation:
1. The title of the experiment
2. The basic principle of the experiment
3. Description of the used method(s)

Part that should be made not later than next week lab:
4. The results of the experiment
5. Conclusions drawn from the experiment

If these are not prepared the lab instructor dismisses the student from the class.
The presence of students on at least 30% of lectures is obligatory and will be recorded. The professor refuses his/her signature in the student's Lecture Book for the semester's course-work if the student was absent from more than 17 lectures, even if the student has an acceptable excuse.

2, Self-control tests
During the semester there will be **three self-control tests** offered in the 5th, 10th and 14th weeks. Participation in at least two of them is required for the signature. The questions include multiple choice and short essay questions, figures, pedigrees, definitions, problems, etc. The questions are selected from a question bank that will be published on the departmental home page (except the multiple choice questions). Based on the % average of the **three tests** a final grade will be offered according to the next table:

Percentage (%)	Grade
60.00 - 64.99	pass (2)
65.00 - 74.99	satisfactory (3)
75.00 - 84.99	good (4)
85.00 - 100	excellent (5)

Those students who want a better mark have to take the regular end of semester “A” exam. The result of this ESE is binding, it can be better, the same or worse than the offered mark. Students with lower achievement than 60 % should take the regular ESE.

Exemption requests:
Applications for exemption (based on previous studies in other universities) should be submitted during the first two weeks of the semester. Requests are not accepted after that deadline! Exemption is granted only, if the student can pass an "Assessment of knowledge" test. The passing limit is 50%.

Rules concerning repeaters:
Attendance of labs and seminars for those repeaters who have a signed lecture book from the previous year (i.e. they failed, or they are repeaters because they have never taken Molecular Genetics exam) is dispensable. Students should register for the subject electronically during the first weeks of the semester. They can take the three midterm tests in order to qualify for offered grade or test bonuses and they take the regular exam at the end of the semester. They cannot have home-work bonuses. Students, who did not earn a signature in the previous year, have to register and attend the labs and seminars and they are considered as the other students registering the course at the first time.

End of Semester Examination (ESE):
There will be a written examination at the end of the semester (ESE) that covers all the material of the semester taken in the lectures, seminars, laboratory practices and required parts of the textbook (for a detailed list see the University Bulletin). The examination questions include multiple choice and short essay questions, figures, definitions, etc. The marks are based on the student's performance, expressed in percentage (%) as shown in the table below:

Percentage (%)	Grade
0 - 49.99	fail (1)
50.00 - 64.99	pass (2)
65.00 - 74.99	satisfactory (3)
75.00 - 84.99	good (4)
85.00 - 100	excellent (5)

The percentage values include the student's performance at the ESE as well as the bonus percentage they have obtained by taking the three mid-semester tests.
The following table shows the bonus percentage based on the average result of the semester tests. Absence counts as 0%.

Average of the 3 tests (%)	Bonus (%)
50.00 - 53.99	1
54.00 - 57.99	2
58.00 - 61.99	3
62.00 - 65.99	4
66.00 - 69.99	5
70.00 - 73.99	6
74.00 - 77.99	7
78.00 - 81.99	8
82.00 - 85.99	9
86.00 - 100	10

Further bonuses can be given for the timely completion of the following midterm homeworks:

Problem solving in genetics (1 bonus)
Analysis of human karyograms (1 bonus)
Data search in human genetic databanks through the Internet (1 bonus)
Problem solving in population genetics (1 bonus)

Only those home works are accepted for evaluations which are turned in within one week after the students receive them. The submission of the home-works is voluntary. Home-works are not accepted after the submission deadline.
Bonuses are calculated only in the year of acquisition.
Lecture and seminar files, hand-outs and up-to-date information can be found at https://elearning.med.unideb.hu, username and password is your network-id (same as Neptun-id) and password. You will be able to check the content after the Neptun has registered you to the subject.
Departmental homepage: https://humangenetics.unideb.hu

Department of Immunology

Subject: **MOLECULAR IMMUNOLOGY**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**
Seminar: **10**

1st week:
Lecture: Elements of the immune system and their role in defense against pathogens. Components and cells of the innate response. Characteristics and function of the innate immune response. The structure of lymphoid tissues and organs.

2nd week:
Lecture: Structure and function of proteins encoded by the major histocompatibility (MHC) gene complex. Processing and presentation of antigens. T-lymphocytes. Requirements and consequences of T-cell activation.

3rd week:
Lecture: B-lymphocytes. Characteristics of the acquired immune response. An introduction to antibody structure and function. Lymphatic circulation, immune surveillance by re-circulation of immunocytes within the immune system. Inflammation and the acute phase response.

4th week:
Lecture: Recognition of pathogens by the innate arm of the immune system. Elimination of pathogens by the innate arm of the immune system. The complement system. The role of innate lymphoid cells in immunresponse.
Seminar: B- lymphocytes. Characteristics of the acquired immune response. An introduction to antibody structure and function. Lymphatic circulation, immune surveillance by re-circulation of immunocytes within the immune system. Inflammation and the acute phase response.

5th week:
Lecture: Generation of B-cell receptor diversity. Antigen-independent differentiation of B-lymphocytes. Antigen-dependent differentiation of B-lymphocytes. B-cell activation. Production of various antibody isotypes and their functions.
Seminar: Recognition of pathogens by the innate arm of the immune system. Elimination of pathogens by the innate arm of the immune system. The complement system. The role of innate lymphoid cells in immunresponse.

Self Control Test

6th week:
Lecture: Effector function of helper T-cell. Activation and function of cytotoxic T-lymphocytes. T-cell development. Central tolerance. Mechanisms of peripheral tolerance.
Seminar: Generation of B-cell receptor diversity. Antigen-independent differentiation of B-lymphocytes. Antigen-dependent differentiation of B-lymphocytes. B-cell activation. Production of various antibody isotypes and their functions.

7th week:
Lecture: The function of regulatory T-cells. The development of immunological memory. Monoclonal antibodies. Vaccination.
Seminar: Effector function of helper T-cell. Activation and function of cytotoxic T-lymphocytes. T-cell development. Central tolerance. Mechanisms of peripheral tolerance.

8th week:
Seminar: The function of regulatory T-cells. The development of immunological memory. Monoclonal antibodies. Vaccination.

9th week:
Self Control Test

Requirements

Signing of the Lecture Book:
Participation in the Seminars is compulsory, 1 absence is allowed. If there are more abscences, the Department shall refuse to sign the students' Lecture book.

Self control tests (SCTs), offered grades, end-term exam:
During the semester two self control test (SCT) will be organised (weeks 5 and 9).
The first SCT contains the material of the lectures of weeks 1-3 as well as the material of seminar on week 4. To ensure a solid basic knowledge of immunology, students must score higher than 70% to qualify for the 2nd SCT, hence for an offered grade.
The 2nd SCT contains the material of lectures 4-7, respectively including the materials the material of seminars 5-8.
If a student's score for the first SCT is higher than 70% and is higher than 50% for the 2nd SCT, she/he will be offered a grade. Should student accept this offered grade, she/he will be exempted from the end-term exam.
The offered grades are calculated by the following algorithm, based on the cumulative percentage points of the two SCTs (i.e. 200 points maximum).

120 - 139: pass (2)
140 - 159: satisfactory (3)
160 - 179: good (4)
180 – 200: excellent (5)

Those students who have not qualified for an offered grade must take the end-term exam during the exam period. The end-term exam consists of a written and an oral part.
"A" exam: To qualify for the oral part of an "A" exam, students must score higher than 70% on the written (entry) exam. Students who score less than 70% on the written part will fail (thus, the oral exam will not take place).
"B" exam: "B" exams are identical to "A" exams except when the student failed the oral, but not the written, part of the "A" exam. With a score of higher than 70% on the written part of the "A" exam,

the student is exempt from the written exam on the "B" exam.
"C" exam: "C" exams are oral exams only, without a written entry test.
Those students who would like to improve the grade of a successful ("A" or "B" exam) or do not accept the offered grade, are also exempted from the entry test.
The list of exam topics is available on the departmental website (www.elearning.med.unideb.hu).
Lecture materials and other information concerning education can be found on our website at www.elearning.med.unideb.hu.

Department of Medical Chemistry

Subject: **METHODS OF MOLECULAR BIOLOGY**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: 1.Isolation of nucleic acids
2.Enzymes of nucleic acid manipulation

2nd week:
Lecture: 3.Cloning of DNA
4.DNA libraries

3rd week:
Lecture: 5.Nucleic acid hybridization
6.DNA chips

4th week:
Lecture: 7.Fluorescence*in situ*hybridization (FISH)
8.Comparative genomic hybridization (CGH)

5th week:
Lecture: 9.PCR and LCR
10.PCR applications
1st control test

6th week:
Lecture: 11.*In vitro* mutagenesis
12.Genome editing

7th week:
Lecture: 13.Genome projects
14.New generation DNA sequencing

8th week:
Lecture: 15.Protein purification
16.Protein analysis
2nd control test

9th week:
Lecture: 17.Preparation of antibodies
18.Immunological methods in molecular biology

10th week:
Lecture: 19.Detection of protein-protein interactions
20.Quantitative analysis of protein interactions

11th week:
Lecture: 21.Proteomics
22.Mass spectroscopy for protein analysis
3rd control test

12th week:
Lecture: 23.Expression of recombinant proteins
24.Biotechnology

13th week:
Lecture: 25.Gene silencing and KO animals
26.Gene therapy

14th week:
Lecture: Discussion
4th control test

Requirements

The program consists of a series of lectures that aim to extend the molecular biology knowledge of the first year MSc. students and provide a solid methodological basis for experiments to be performed in the next semester during molecular biology practical. The course is divided into four teaching blocks. At the end of each block a written self-control test will be held to evaluate the midterm progress of the students. The self-control tests will be evaluated according to the following table:

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

The average result of these tests will be used as an offered mark at the end of the semester, provided all of the tests were successfully completed at least with a passing grade. The students are expected to accept these offered grades in the Neptun system before the start of the examination period. In the absence of an accepted offered grade the students have to sit for an ESE during the exam period in accord with the rules and regulations of the Faculty of Medicine, University of Debrecen.

ESE is a written test composed of four assay questions, each covering a lecture of the given teaching block as described below:

1st block: Lectures 1-8
2nd block: Lectures 9-14
3rd block: Lectures 15-20
4st block: Lectures 21-26

The knowledge of each block at least at the basic level is required for the passing grade.

Textbook:
J. Sambrook, E. F. Fritsch, T. Maniatis: Molecular Cloning, A laboratory manual, 3rd edition, Cold Spring Harbor Laboratory Press, 2001
Materials published in the web site.
e-mail: molecbiol@med.unideb.hu

Department of Physiology

Subject: **HUMAN PHYSIOLOGY I.**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:	Introductory remarks
Lecture:	Humoral regulation of cell function

2nd week:
Lecture:
Electrical properties of the cell membrane
The mechanism of action potential

3rd week:
Lecture:
Physiology of the body fluids. Liquor. Blood plasma.
Functions of plasma proteins

4th week:
Lecture:
Red blood cells, white blood cells. Blood types. Hemostasis

5th week:
Lecture: Electrophysiology of cardiac cells
Self Control Test

6th week:
Lecture:
Mechanics and contractility of cardiac cells
The cardiac cycle, regulation of cardiac output

7th week:
Lecture:
Principles of hemodynamics, arterial circulation and microcirculation
Regulation of MAP I.

8th week:
Lecture:
Regulation of MAP II.
Regulation of circulation of specific organs
9th week:
Lecture: Functions of endothelium
Self Control Test

10th week:
Lecture:
Mechanics of respiration
Control of breathing

11th week:
Lecture:
Physiology of the gastrointestinal tract I
Physiology of the gastrointestinal tract II

12th week:
Lecture:
Food intake and its regulation
Energy balance

13th week:
Lecture:
Regulation of striated muscle contraction
Smooth muscle physiology

14th week:
Lecture: tutorial
Self Control Test

Requirements

1. Verification of the semester
Attendance oft lectures is compulsory. If one has more than 2 lecture absences, the end-semester examination (ESE) may not be substituted with the average test score (see later). For continuous updates on all education-related matters, please check the elearning.med.unideb.hu web site (Department of Physiology menu item).

2. Evaluation during the semester (mid-semester tests)
The knowledge of students will be tested 2 times per semester in the form of a written test (multiple choice questions). Participation on mid-semester written tests is compulsory.

3. Examination
The first semester is closed by an end-semester exam (ESE) covering the topics of all lectures. The A and B chances of the end-semester exams are written tests (multiple choice questions), while the

C chance is an oral exam. The grade of the written test is calculated according to the following table:

Scoremark
0 – 59.9 %: fail
60 – 69.9 %: pass
70 – 79.9 : satisfactory
80 – 89.9 %: good
90 – 100 %: excellent

ESE grade based on the average score of mid-semester tests will be offered if one's average score of the three mid-semester tests is above 60% and none of the individual tests' results are less than 50%. and (s)he has fewer than 3 lecture absences (see the table above).
- If one is not satisfied with the offered grade, (s)he may participate in ESE during the examination period. In his case the previously offered grade is cancelled.

Division of Biophysics

Subject: **BIOPHYSICS**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: 1. Introduction. Electromagnetic waves , the properties of light (interference, photoelectric effect, photon theory). Matter waves. Thermal radiation.
2. Generation and absorption of X-ray, X-ray crystallography.
Seminar: Although there are no Biophysics seminars in Molecular Biology MSc training program, we encourage students to attend one General Medicine or Dentistry Biophysics seminar. (See timetable on the webpage of Department of Biophysics and Cell Biology.) Please notify the manager of education your seminar attendance.

2nd week:
Lecture: 3. Molecule spectra, Jablonski diagram, fluorescence, fluorescence applications.
4. Sedimentation and electrophoresis. Mass spectrometry.

3rd week:
Lecture: 5. Optics, optical microscopy, electron microscopy.
6. Lasers and their application in biology and medicine.

4th week:
Lecture: 7. Physical properties of sound, ultrasound. Doppler effect. Medical and biological applications of ultrasound.
8. Nuclear physics. Nuclear binding energy, radioactivity, law of radioactive decay, radioactive series.

5th week:
Lecture: 9. Features of nuclear radiation and its interaction with absorbing material. Detection of radiation.
10. Radiation biophysics: target theory, direct and indirect action of radiation. Dosimetry. Biological effects of radiation.

6th week:
Lecture: 11. Experimental, diagnostic and therapeutic application of isotopes. Accelerators.
12. Basic principles of nuclear magnetic resonance, NMR spectroscopy in biology and medicine.

7th week:
Lecture: 13. Principles of tomographic methods. X-ray absorption CT. PET.
14. Magnetic resonance imaging (MRI). Gamma camera, SPECT, PET.
8th week:
Lecture: 15. Chemical potential. Brownian motion. Diffusion at the molecular level, statistical interpretation. Fick's laws. Osmosis.
16. The structure of biological membranes. Membrane transport.

9th week:
Lecture: 17. Thermodynamic equilibrium potentials (Nernst, Donnan). Diffusion potential, Goldman-Hodgkin-Katz equation.
18. Resting potential, action potential, and electrical excitability. Measurement of membrane potential.

10th week:
Lecture: 19. Ion channels (gating, selectivity), the "patch clamp" technique.
20. The physical background of ECG and EEG.

11th week:
Lecture: 21. The human ear. Mechanism of hearing. The Weber-Fechner law.
22. The human eye. Photoreceptors. The molecular mechanism of vision.

12th week:
Lecture: 23. Biomechanics.
24. Fluid mechanics, blood circulation.

13th week:
Lecture: 25. Biophysics of respiration.
26. Flow cytometry. Confocal laser scanning microscopy.

14th week:
Lecture: 27. Modern microscopic techniques (atomic force microscopy, super resoltion microscopy)
28. Research in the Institute.

Requirements

Subject: BIOPHYSICS
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: 28
Subject code: AO_MBE_BIF01
ECTS Credit: 3
Department: Department of Biophysics and Cell Biology, Biophysics Division
Semester recommended to take: 1st year 1st semester.
Semester fot the regular course: 1st.
Prerequisites of the course: No prerequisites.
Coordinator: Dr. Andrea Dóczy-Bodnár
Teaching staff: Prof. Dr. Péter Nagy and the members of the Department
Educational manager: Enikő Nizsalóczki (The location and time of office hours are posted on the website.)
E-mail: biophysedu@med.unideb.hu

Aim of the course: To provide the necessary theoretical background for the understanding the physical principles applied in molecular biology, cell biology and medicine and for the description of the role of physical processes in living organisms (e.g. diffusion, electric properties of cells, etc.). Introduction to (bio)physical methods used in molecular and cell biology as well as in medicine (e.g. flow cytometry, microscopy methods, etc.)
Short description of the course: Students will be introduced to the quantitative description of the

physical basis of selected topics in biology and medicine.

Structure of the course:
- Introduction to natural sciences (e.g. basic principles of atomic and nuclear physics)
- Physical principles of methods applied in molecular and cell biology (e.g. electroporesis, sedimentation, mass spectrometry, microscopy, etc.)
- Medical physics (e.g. physical principles of diagnostic and therapeutic procedures)
- Molecular biophysics (e.g. diffusion, membrane biophysics)
- Organ biophysics (e.g. vision, hearing, circulation)

Compulsory reading:
- Educational material uploaded to the educational website (e-Learning surface) of the Department;
- Medical Biophysics textbook (Editors: S. Damjanovich, J. Fidy, J. Szöllősi, Medicina, Budapest, 2009, ISBN: 978-963-226-127-0).

Web page of the Department: http://biophys.med.unideb.hu/en and the link to the Moodle (e-Learning) within.

Exam: Oral exam during the exam period after the 1st semester. Students who attended the course and were granted with signature in a previous semester can take the exam in the 2nd semester as well, in the frame of the exam course (see Requirements, point 9).

Requirements
1. Lectures: Attendance to lectures is not compulsory but emphatically recommended. All material covered in lectures is an integral part of the subject, and therefore included in the self-control tests and the final exam. Some new concepts and ideas are discussed in the lectures only and are not present in the textbook.

2. Seminars: No seminars are included in the course, however, it is recommended to attend the seminars of the medicine students, which might aid preparation for the exam.

3. Exemptions: In order to get exemption from the biophysics course the student has to write an application to the Educational Office. The Department of Biophysics and Cell Biology does not accept such applications.

4. Conditions for the signature: no special requirements.

5. Self-control tests: There will be 2 self-control tests (SCT) during the semester. None of the SCTs are obligatory. Each SCT will be graded (0-100 %, 0% for absence) and the results of the two SCTs will be averaged (Xave). The missed test will be counted as 0% in the average. Missed SCTs cannot be made up at a later time.
Based on the written tests students may be offered the following grades:
55-64.99: pass (2)
65-74.99: satisfactory (3)
75-84.99: good (4)
85-100: excellent (5)

6. Final Examination (FE): Students have three chances (A,B,C) for passing the biophysics final

exam in the winter exam period after the semester in which the course was taken (or in the summer exam period for students registered for the exam course, see point 9).
The FE consists of two parts:
Part I. Minimum requirement questions. It consists of a written quiz of 20 minimum requirement questions. One must pass this part to continue with the oral exam (part II.). Minimum requirement questions and the answers thereto are provided on the website of the Department (biophys.med.unideb.hu). 16 out of 20 have to be answered correctly in order to pass this part. This part of the FE is evaluated as pass or fail, once passed it is valid for further exam chances (B- or C-chance) of the FE.
Part II. Oral exam. Two questions chosen from the topic list (provided on the departmental website) at random should be answered. In order to complete the exam successfully students need to get pass (2) for both questions. Students are exempted from the FE exam if the grade offered based on the self-control tests is accepted by the student (see point 5.).

7. Rules for the usage of calculators during self-control tests and the final examination: In order to ensure a fair evaluation, to avoid disturbances in the testing room, and to protect the security of the test material the following types of calculators are NOT permitted:
- calculators with built-in computer algebra systems (capable of simplifying algebraic expressions)
- pocket organizers, handheld or laptop computers
- any device capable of storing text. Calculators with a typewriter keypad (so-called QWERTY devices), electronic writing pads and pen-input devices are not allowed either. Calculators with letters on the keys (e.g. for entering hexadecimal numbers or variable names) are permitted as long as the keys are not arranged in QWERTY format.
- Calculators or other devices capable of communicating with other devices
- Calculators built into wireless phones
- Calculators with paper tape or models that make noise

In general, students may use any four-function, scientific or graphing calculator except as specified above. However, we reserve the right to prohibit the usage of ANY type of calculator, computer and data storage and retrieval device during some tests if no calculations or only very simple calculations are necessary. Sharing calculators during tests is not allowed, and the test proctor will not provide a calculator.

8. Information for repeaters
- repeating the course means attending the lectures;
- according to the relevant rules (point 5) self-control tests may be written and grade may be offered again;
- the results of the self-control tests written in the failed semester are lost;
- exemption from minimals obtained in the exam period of the failed semester is lost.

9. Information for Exam Course students
Points 1-5 and 8 are irrelevant. Point 6 and 7 applies fully. Results of the self-control test written in the previous semester are lost. Exemptions from minimals obtained in a previous exam period is lost. Only those students may register for the exam course who attended the Biophysics Lecture course in a previous semester and were granted with signature. Exam topics: all the material covered in the semester immediately preceding the semester in which the exam course is taken.

For further information and news, check the web site of the Department (biophys.med.unideb.hu) and the link to the Moodle (e-Learning) within.

Division of Nuclear Medicine and Translational Imaging

Subject: **RADIOISOTOPE TECHNIQUES IN BIOMEDICINE PRACTICAL**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **14**

10th week:
Practical: Half life and gamma spectrum

11th week:
Practical: Labelling and gamma measurement

12th week:
Practical: In vitro isotope diagnostics (RIA)

13th week:
Practical: Dosimetry

14th week:
Practical: Liquid scintillation measurement

Requirements

Aim of the course (partial/complete skills and competencies):
To provide participants with practical training in basic methodologies of analytical laboratory work with radioisotopes. The course will broaden the participants' knowledge of methodological approaches, thus establishing later applications in practice.
There will be 5 blocks of the practicals.
Practical 15, 5x3 hours

Subject: **RADIOISOTOPE TECHNIQUES IN BIOMEDICINE**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Introduction: radioisotopes in biomedicine. Decay modes, interactions of radiation with matter

2nd week:
Lecture: Experimental error calculations, error propagation

3rd week:
Lecture: Settings for scintillation measurements
1st test: Radioactivity, interactions, calculations

4th week:
Lecture: Basic terms and devices of dosimetry. Dose limits.
Biological effects of radiation

5th week:
Lecture: General safety regulations, rules of working with radioisotopes. Compulsory before practices

6th week:
Lecture: "In vitro" isotope diagnostics

7th week:
Lecture: 8 "In vivo" nuclear medicine.
2nd test: Radiation protection, "in vitro" diagnostics

8th week:
Lecture: Analytical methods with radiotracers

9th week:
Lecture: Characteristics and quality control of radiopharmaceuticals

10th week:
Lecture: Labeling techniques, autoradiography

11th week:
Lecture: Analyzing receptor binding and kinetics
3rd test: Labeling, applications

12th week:
Lecture: Students' presentations

13th week:
Lecture: Students' presentations
Review and summary

Requirements

Aim of the course (partial/complete skills and competencies):
To get acquainted with the possibilities of applying radioisotopes in biological and medical research, and the safety rules of handling radionuclides.

Topics: basics of atomic physics, decay modes, law of decay; interactions of radiation with matter; methods and devices for detecting radiation: gas ionization and scintillation detectors, liquid scintillators, autoradiography; evaluation of the results of measurements; basic terms and devices of dosimetry; dose calculations; radiation protection, the biological effects of radiation; basic rules of working with radioisotopes, general safety regulations; applications: protein labelling techniques, analyzing receptor binding and kinetics, molecular biology

Further info: http://www.pet.dote.hu/Learning/index.php?option=com_content&view=article&id=78&Itemid=266

Department of Biochemistry and Molecular Biology

Subject: **BIOINFORMATICS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Introduction to bioinformatics

2nd week:
Lecture: Definition of 'omics'. Sequencing technologies. Functional genomics approaches, connection with bioinformatics. The human genome project.

3rd week:
Lecture: The basics of database technology. Databases in molecular biology. Primary databases.

4th week:
Lecture: Protein and protein domain databases. Special emphasis on the UNIPROT and INTERPRO databases.

5th week:
Lecture: Other databases. The TAXONOMY, evolutionary and GO databases.

6th week:
Lecture: Text searches in databases. Using the text search engines of Google and the main bioinformatics portals. Usage of PubMed, Entrez and SRS.

7th week:
Lecture: Algorithms for similarity searches. Pairwise alignments. The DOTPLOT method, local and global analyses.

8th week:
Lecture: Similarity searches in databases. The FASTA and BLAST algorithms and their usage. The BLAST and MEGABLAST program. Multiple alignments.

9th week:
Lecture: Bioinformatics program packages for molecular biology. Introduction to the EMBOSS program package.

10th week:
Lecture: Introduction to the main programs in the EMBOSS program package.

11th week:
Lecture: Bioinformatic aspects of molecular phylogenetics. Multiple alignment and the evolutionary tree. Distance and character based methods.

12th week:
Lecture: Structural bioinformatics

13th week:
Lecture: Transcriptomics and bioinformatics.

14th week:
Lecture: Bioinformatics for next generation sequencing. Short read alignment, analysis of ChIP-seq and RNA-seq data, de novo genome assembly. The GWAS technology.

Requirements

Requirements for oral examination:
Participation in the obligatory lectures. Only one absence is accepted from the obligatory lectures - in case of more absences students will not be permitted to take the oral exam.
Grading: Grades will be offered based on oral examination during the exam period. The student's performance will be assessed on a five-grade scale. The list of exam topics and the examination rules will be announced by the Department at the beginning of the semester (lecture slides are available at the https://elearning.med.unideb.hu web site, login with your university network ID and password). Students may take one improvement exam per exam period.

Subject: **BIOINFORMATICS PRACTICALS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **14**

2nd week:
Practical: Using the sequence and domain databases. Downloading and analysis of sequence records from the EMBL, GenBank and SwissProt databases. Searching the INTERPRO database. Possible usages of SRS text search.

3rd week:
Practical: Annotation of novel metagenomic sequences at the annotathon.org website. Identification of open reading frames, calculation of protein MW. Searching for protein domains in the INTERPRO database. Searching for similar proteins with BLAST, taxonomy classification based on the BLAST results and the phylogenetic tree.

4th week:
Practical: Annotation of novel metagenomic sequences at the annotathon.org website. Identification of open reading frames, calculation of protein MW. Searching for protein domains in

the INTERPRO database. Searching for similar proteins with BLAST, taxonomy classification based on the BLAST results and the phylogenetic tree.

5th week:
Practical: Annotation of novel metagenomic sequences at the annotathon.org website. Identification of open reading frames, calculation of protein MW. Searching for protein domains in the INTERPRO database. Searching for similar proteins with BLAST, taxonomy classification based on the BLAST results and the phylogenetic tree.

6th week:
Practical: Annotation of novel metagenomic sequences at the annotathon.org website. Identification of open reading frames, calculation of protein MW. Searching for protein domains in the INTERPRO database. Searching for similar proteins with BLAST, taxonomy classification based on the BLAST results and the phylogenetic tree.

14th week:
Lecture: Structural bioinformatics

Requirements

Requirements for grade offer:
Students are required to attend the practicals. Only one absence is accepted from the practicals - in case of more absences students will not be offered a grade.

Grading: Grades will be offered based on the student's performance during the practicals, on a five-grade scale. The list of evaluation topics and the evaluation rules will be announced by the Department at the beginning of the semester.

Subject: **CELL AND ORGAN BIOCHEMISTRY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**
Seminar: **14**
Practical: **14**

1st week:
Lecture: RNA world I

2nd week:
Lecture: RNA world II.
Practical: Polymerase chain reaction - basics of experimental design and optimization.
3rd week:
Lecture: Transgene and knockout technologies I.
Practical: PCR primer design 1. Detection of alternative splice variants. Identify and download the target sequence from the Ensembl database. Primer design with the Primer3+ program. Quality control: IDT Oligoanalyzer program.

4th week:
Lecture: Transgene and knockout technologies II.
Practical: PCR primer design 2. Design of composite primers for directional cloning.

5th week:
Lecture: Stem cells I.
Practical: PCR primer design 3. Primer design for site directed mutagenesis. Identification of potential miRNA binding sites with the Targetscan program. 3' UTR sequence download from the UCSC Genome Browser database.

6th week:
Lecture: Stem cells II.
Practical: PCR primer design 4. Design of sequencing primers.

7th week:
Lecture: Tumor microenvironment
Practical: Independent work and report writing
Self Control Test (Topics for week 1-6.)

8th week:
Lecture: Intrinsically disordered proteins
Practical: Independent work and report writing

9th week:
Lecture: Neurobiochemistry
Practical: Independent work and report writing

10th week:
Lecture: Tumor metabolism

11th week:
Lecture: Autophagy
Self Control Test (Topics of weeks 7-10)

12th week:
Lecture: Endoplasmic reticulum stress

13th week:
Lecture: Epigenetics I

14th week:
Lecture: Epigenetics II
Self Control Test (Topics of weeks 11-14.)

Requirements

Content of Organ and Cell Biochemistry: Topics presented at the lectures and discussed during the seminars (available at the https://elearning.med.unideb.hu web site, login with your university network ID and password). At the weekly seminars the lectures of the previous week will be discussed with the seminar teacher.

Requirements for the written exam: Participation in the seminars and in the practical. Only one unexcused absence is accepted from the practicals, and three absences are accepted from the seminars. Students will also have to submit the written report of their independent practical work in time. In case of more absences or missed report submission students will not be permitted to take the written exam.

Self-control tests: (not obligatory) During the semester students may choose to write 3 self-control tests addressing the curriculum of the lectures and seminars. The self-control tests consist of single-choice and multiple-choice test questions, and by writing the 3 tests a total of maximum 70 points can be collected. If the combined score of the 3 tests is above 60% of the total score, grades will be offered at the end of semester.

Grading:
2 (pass) 42-48 points,
3 (satisfactory) 49-55 points,
4 (good) 56-62 points,
5 (excellent) 63-70 points.

Grading: Grades will be offered based on the combined score of the self control tests, or based on the score of the written examination during the exam period. The written exams also consist of single-choice and multiple-choice test questions - a maximum of 100 points can be collected.

The student's performance will be assessed on a five-grade scale.
pass (grade 2): 60-69 points;
satisfactory (grade 3): 70-79 points;
good (grade 4): 80-89 points;
excellent (grade 5): 90-100 points.

Students may take one improvement exam per exam period. Students must register for the exams on the NEPTUN until the end of the 15th week.
Please follow the announcements of the department on the announcement table (LSB downstairs 1st corridor), and on the website (http://bmbi.med.unideb.hu)

Subject: **THESIS PROJECT WORK I.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **70**

Department of Botany

Subject: **PLANT MOLECULAR BIOLOGY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**
Seminar: **28**

1st week:
Lecture: General informations. Introduction into the main topics of plant molecular biology.
Seminar: Discussion of seminar topics.

2nd week:
Lecture: The dynamic plant cell. The coordination between ER and microtubules for the concerted functioning of plant cell. Dynamics of organelles, with special emphasis on vacuoles.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant cell dynamics. Students present selected topics of this subject on the basis of scientific papers.

3rd week:
Lecture: Organization of nuclear and organellar genome, particularities of transcription and translation in plants. Special plant proteins. Biotechnological aspects.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant molecular genetics. Students present selected topics of this subject on the basis of scientific papers.

4th week:
Lecture: Gene regulation in plants, with special emphasis on light-regulated expression. Post-transcriptional and post-translational regulation in plants.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant gene regulation as well as post-transcriptional and post-translational regulations. Students present selected topics of this subject on the basis of scientific papers.

5th week:
Lecture: Particularities of the organization of plant cytoskeleton. Cell cycle regulation in plants.
Seminar: Discussion of the topics presented at

the lecture. Modern techniques related to the study of plant cytoskeleton and cell cycle regulation. Students present selected topics of this subject on the basis of scientific papers.

6th week:
Lecture: Photoreceptors: phytochromes, blue and UV receptors. Signal transduction events in photomorphogenesis. Regulation of gene expression by phytochromes. Chronobiology in plants.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of photomorphogenesis. Students present selected topics of this subject on the basis of scientific papers.

7th week:
Lecture: Electron transport proteins in photosynthesis. Short characterization of the Calvin cycle. Molecular/ gene regulation of C- and N metabolism in plants.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of C- and N metabolism in plants. Students present selected topics of this subject on the basis of scientific papers.

8th week:
Lecture: Signal transduction events mediated by plant growth regulators, with special emphasis on auxins. Functions of PIN proteins (auxin efflux carriers).
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant hormone mediated signal transduction and auxin transport. Students present selected topics of this subject on the basis of scientific papers.

9th week:
Lecture: Molecular mechanisms of embryo and root development, the role of plant growth regulators.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of shoot and flower development. Students present selected topics of this subject on the basis of scientific papers.

10th week:
Lecture: Molecular mechanisms of shoot and flower development, the role of plant growth regulators. Flower identity genes: the role of MADS box (homeotic) genes, analogies with homeobox genes-regulated developmental processes in animals.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of shoot and flower development. Students present selected topics of this subject on the basis of scientific papers.

11th week:
Lecture: Plant responses to abiotic and biotic stresses. The formation of reactive oxygen species. Antioxidant systems and metabolites in plants.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant stress responses. Students present selected topics of this subject on the basis of scientific papers.

12th week:
Lecture: Molecular mechanisms of senescence and plant cell death in plants. Plant-pathogen interactions, the hypersensitive response.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant cell death. Students present selected topics of this subject on the basis of scientific papers.

13th week:
Lecture: Secondary metabolism in plants, their synthesis.. Terpenoids, alkaloids, phenoloids, polyketides.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the study of plant secondary metabolism. Students present selected topics of this subject on the basis of scientific papers.

14th week:
Lecture: Functions, effects of special plant metabolites. Allelopathy.
Seminar: Discussion of the topics presented at the lecture. Modern techniques related to the

study of plant special metabolites. Students present selected topics of this subject on the basis of scientific papers.

Requirements

The program consists of lectures, seminars and laboratory practices. Attendance at seminars is recorded. Students should attend at least 80% of seminars.

Textbook:
Plant Biology Manual, Department of Botany. Material is published on the botany.ttk.unideb.hu web page.

Subject: **PROBLEM-SOLVING EXERCISES IN MOLECULAR BIOLOGY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **45**

Requirements

Aim of the course (partial/complete skills and competencies):
The aim of the course is to give differentiated professional knowledge about a selected area of molecular biology. All departments involved in molecular biology education are entitled to announce exercises. The extensive collaboration offers possibility for students to encounter the present day problems and questions of molecular biology and search for the answers. Students can join to the current research projects and learn the independent laboratory work. This prepares them for their future work as a PhD or research group leader, which requires problem solving thinking and enables them to find the correct answers.
By acquiring the course material students will get a more in-depth knowledge of the related literature, will become able to solve problems using the method and summarize the results in a comprehensible form.

Topics:
The project is the elaboration of an exercise that can be solved using molecular biological methods. The student gathers the possible methods leading to the solution (reading the literature) and suggests a solution with the method he believes the best. The student designs and performs the experiments and analyzes the data with the help of the supervisor. Students must summarize their work in a written report of 8-10 pages.
Recommended literature:
Related to the projects, offered by the tutors

Department of Medical Chemistry

Subject: **METHODS IN MOLECULAR BIOLOGY PRACTICALS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **46**

1st week:
Practical: 1.Genotyping: DNA preparation, PCR, Agarose gel electrophoresis
2.Investigation of gene expression: Cell culturing, RNA preparation, measurement of RNA concentration, RT reaction, PCR, Agarose gel electrophoresis
3.DNA cloning: Cultivation of*E. coli*, Preparation of competent cells, Ligation, Transformation, Detection of GFP
Demonstration: Quantitative PCR

2nd week:
Practical: 4.Investigation in proteins: Extraction of proteins, SDS-PAGE, Western blotting
5.Purification of recombinant GFP by affinity chromatography
6.Plasmid mini-preparation: Preparation of DNA, Restriction analysis, Agarose gel electrophoresis
7.Detection of antigenes from blood: ELISA
8.Immunocytochemistry: Isolation, labelling and microscopic analysis of cells

Requirements

The successful completion of the exercises and the presence of the students at the demonstration will be acknowledged by the signature of the instructor. In the absence of these signatures the course will not be accepted. In case of justified absence the instructor offers one chance to make up the missed practical class.

The work of the student will be evaluated based on the notebook prepared by the student independently during the practical classes. The practical grade may be improved once, by upgrading/rewriting the notebook.

Textbook:
J. Sambrook, E. F. Fritsch, T. Maniatis: Molecular Cloning, A laboratory manual, 3rd edition, Cold Spring Harbor Laboratory Press, 2001

Teaching materials: website.
e-mail: molecbiol@med.unideb.hu

Department of Medical Microbiology

Subject: **PHYSIOLOGY OF PROKARYOTES AND MOLECULAR VIROLOGY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**
Practical: **14**

1st week:
Lecture: Structure and taxonomy of viruses.Virus replication.

2nd week:
Lecture: Replication strategies of viruses.

3rd week:
Lecture: Pathogenesis of viral infections

4th week:
Lecture: Virus-host interactions. Tumour viruses.

5th week:
Lecture:
Host defense against viral infections. Evasion of immune responses by viruses.

6th week:
Lecture: Immunization. Vaccine types.

7th week:
Lecture: Antiviral treatment. Prions.

8th week:
Lecture:
Bacterial cell structure. Propagation of bacteria.
Practical:
Propagation of bacteria. Macroscopic, microscopic morphology.
Demonstration:
Bacteria on solid media
Staphylococcus aureus
α-haemolytic Streptococcus
Bacillussubtilis
Escherichia coli
Klebsiella p.
Proteus mirabilis
Pseudomonas aeruginosa
2.Stained smears.
Working task:
1. Preparing smear from bacterial cultures. Gram staining of smears.(*Staphylococcus aureus, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa)*
2. Examination of macroscopic morphology
3. Microscopic examination of bacteria
4. Culturing of *Escherichia coli*
2nd day:
Biochemical tests.
Demonstration:
a.MR (methyl-red reaction): *E. coli, Klebsiella sp.*
b.VP (Voges-Proskauer reaction): *E. coli, Klebsiella sp.*
c.Esculin hydrolisis (BEA medium): *Enterococcus faecalis*
indol test: *E. coli, Klebsiella sp.*
e.ureum hydrolisis test*: E. coli, Klebsiella sp.*
f.phenylalanin-deaminase test: *Proteus sp., E. coli*
g.Oxidase reaction: *Pseudomonas sp., E. coli*
h.Catalse test: *S. aureus, E. faecalis*
i.Coagulase test: *S. aureus, S. epidermidis*
Working task:
1.MR (methyl-red reaction): *E. coli, Klebsiella sp.*
2.VP (Voges-Proskauer reaction): *E. coli, Klebsiella sp.*
3.indol test: *E. coli, Klebsiella sp.*
4.Oxidase reaction: *Pseudomonas sp., E. coli*
5.Catalse test: *S. aureus, E. faecalis*
6.Coagulase test: *S. aureus, S. Epidermidis*
7.*Calturing of bacteria (E. coli) for antibiotic sensitivity test*
3rd day:
Antibiotic sensitivity tests. Serological reactions.
Demonstration:
ELISA, Western-blot.
Working task:
VDRL
Slide agglutination (*Escherichia coli)*
Validation and interpretation of ELISA, Western-blot
Evaluation of antibiotic sensitivity test.

9th week:
Lecture: Prokaryotic genome. Bacterial DNA replication.Plasmids, transformation of bacteria
Practical:
4th day: Propagation of viruses(animals, embrionated egg, cell cultures)
Working task:
Inoculation of embrionated egg with “virus”
5th day: Propagation of viruses
Harvesting and freezing the chorioallantoic fluid (“virus solution”) from the infected embrionated eggs.
6th day: Direct and indirect detection of viruses, viral infections
Demonstration:
Haemagglutination inhibition.
Working task:

Haemagglutination. Calculation the haemagglutination titer.

10th week:
Lecture: Prokaryotictranscription and translation. Regulation of gene expression in prokaryotes.
Practical: 2nd week practice:
4th day: Propagation of viruses (animals, embrionated egg, cell cultures)
Working task:
Inoculation of embrionated egg with "virus"
5th day: Propagation of viruses
Working task:
Harvesting and freezing the chorioallantoic fluid ("virus solution") from the infected embrionated eggs.
6th day: Direct and indirect detection of viruses, viral infections
Demonstration:
Haemagglutination inhibition.

Working task:
Haemagglutination. Calculation the haemagglutination titer.

11th week:
Lecture: Photosynthesis of bacteria.*Chemolithotrophic bacteria. Bacterial catabolism. Archea.*

12th week:
Lecture: Pathogenicity, virulence. Mechanisms of secretion.

13th week:
Lecture: Control of microbial growth I. Sterilization, disinfection

14th week:
Lecture: Control of microbial growth II. Antibacterial therapy

Requirements

The program consists of lectures and laboratory practices. Attendance at laboratory practices and lectures is recorded. Students should attend 100% of laboratory practices. Students should prepare a laboratory notebook which is collected at the end of the practices. From the 2nd week at the beginning of the lecture a short (10-15 min) test is written during the whole semester. Test contains questions about the materials from the previous lecture and the actual practice. Based on the cumulative results of the tests, students are offered an End-Semester-Examination (ESE) grade. Those who are not satisfied with the offered grade or are bellow the passing level, should take an end- semester-examination (A –chance) hold in the examination period. The student's test will be assessed on a five-grade scale. The written examination (A, B and C chance) consists of assay questions. In case of failed results based on the written part of the C chance, the examination continues with oral examination. The examination rules will be announced during the semester.

Compulsory literature:
White D.: The Physiology and Biochemistry of Prokaryotes, 4th edition, Oxford University Press, 2011
Dimmock, N., Easton, A., Leppard, K: Introduction to Modern Virology, 7th edition, Wiley-Blackwell, 2016
Recommended literature:
Christopher Burrell Colin Howard Frederick Murphy : Fenner and White's Medical Virology (Fifth Edition), Academic Press, 2017

Department of Physiology

Subject: **HUMAN PHYSIOLOGY II.**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture:
Principles of renal morphology and renal function
Quantitative description of renal function

2nd week:
Lecture:
Mechanism and regulation of glomerular filtration
Tubular transport processes

3rd week:
Lecture:
Osmoregulation, water balance, diuretics
Defense of body fluid volume, sodium balance

4th week:
Lecture:
Acid-base balance and acid-base disturbances
Potassium balance, mycturition

5th week:
Lecture: General principles of endocrinology.
Self Control Test

6th week:
Lecture:
Pituitary gland, growth hormone
The hormones of thyroid gland

7th week:
Lecture:
The hormonal regulation of basal metabolic rate
Male, Female gonadal functions

8th week:
Lecture:
Pregnancy, lactation
The hormones of adrenal cortex

9th week:
Lecture:
The hormones of adrenal medulla, stress
The hormones of pancreatic islets

10th week:
Lecture: Endocrine regulation of intermedier metabolism
Self Control Test

11th week:
Lecture:
Calcium balance, physiology of bone
Sensory function of nervous system

12th week:
Lecture:
Mechanisms of vision, hearing and vestibular sensation. The taste and olfactory systems
Somatomotor functions and spinal cord reflexes, proprioceptiv and nociceptive reflexes.

13th week:
Lecture:
Role of brainstem, basal ganglia and cerebral cortex in motor-coordination.
Cerebral Cortex, Intellectual Functions of the Brain,

14th week:
Lecture: Learning, memory, speech.
Self Control Test

Requirements

1. Verification of the semester
Attendance of lectures is compulsory. If one has more than 2 lecture absences, the end-semester examination (ESE) may not be substituted with the average test score (see later). For continuous updates on all education-related matters, please check the elearning.med.unideb.hu web site (Department of Physiology menu item).

2. Evaluation during the semester (mid-semester tests)
The knowledge of students will be tested 3 times per semester in the form of a written test (multiple choice questions). Participation on mid-semester written tests is compulsory.

3. Examination
The semester is closed by an an end-semester exam (ESE) covering the topics of all lectures of the semester. The A and B chances of the end-semester exams are written tests (multiple choice questions), while the C chance is an oral exam. The grade of the written test is calculated according to the following table:

Scoremark
0 – 59.9 %:fail
60 – 69.9 %pass
70 – 79.9 %satisfactory
80 – 89.9 %good
90 – 100 %excellent

ESE grade based on the average score of mid-semester tests will be offered if one's average score of the three mid-semester tests is above 60% and and none of the individual tests' results are less than 50%. and (s)he has fewer than 3 lecture absences (see the table above).
- If one is not satisfied with the offered grade, (s)he may participate in ESE during the examination period. In his case the previously offered grade is cancelled.

Subject: **HUMAN PHYSIOLOGY PRACTICALS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **28**

1st week:
Practical: Investigation of the cardiovascular functions.

2nd week:
Practical: Determination of parameters characterising the respiratory functions

3rd week:
Practical: Examination of the blood.

4th week:
Practical: Computer aided aquisition and processing of biological signals.

5th week:
Practical: Effects of electrolytes on the uterinal smooth muscle function.

6th week:
Practical: Effects of neurotransmitters and hormones on the uterinal smooth muscle function.

7th week:
Practical: Computer simulation of the frank-

straling-mechanism

8th week:
Practical: Simulation of the renal transport mechanisms.

9th week:
Practical: Computer simulation of the glucose tolerance test.

10th week:
Practical: Remedial lab.

11th week:
Practical: Closing lab

Requirements

1. Verification of the semester
Attendance of laboratory practices is compulsory. The verification of the semester may be refused for the semester in case of more than two absences from the practices. All missed practices must be made up. Completion of all topic sheets in the Exercise Book, each verified by the signature of the teacher, is also a precondition of the signature of the Lecture Book.
For continuous updates on all education-related matters, please check the elearning.med.unideb.hu web site (Department of Physiology menu item).

2. Evaluation during the semester
Laboratory practical knowledge of the students will be tested at the end of the semester as part of the Lab Exam. As a precondition of attending the Lab Exam, the fully completed Exercise Book (with all the verified topics) must be presented during the Lab Exam. Students are expected to perform the given experiment on their own and must be familiar with theoretical background also. In case of a negative result, the Closing Lab can be repeated, but only once before the beginning of the exam period.

Division of Biomathematics

Subject: **BIOSTATISTICS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **14**

4th week:
Lecture: Set theory. Random events. Conditional probability, marginalization. Independent events. Descriptive statistics. Measure of center and spread.Set theory. Random events. Conditional probability, marginalization. Independent events. Descriptive statistics. Measure of center and spread.

5th week:
Lecture: Random variables. Distribution function and cumulative distribution function of random variable. Discrete probability distributions: binomial and Poisson-distribution.

6th week:
Lecture: Continuous random variables; probability density function. Normal and standard normal distribution. Statistical design and analysis; sampling, estimation.Central limit theorem.

7th week:
Lecture: Hypothesis testing. Null hypothesis.

Statistical significance. One- and two tailed tests. The z-test. One sample t-test.

8th week:
Lecture: Paired t-test. F-test. Unpaired t-test.

9th week:
Lecture: Conditional probability in medicine, screening tests. ROC curve. Epidemiologic investigations: odds ratio and relative risk. The Kaplan-Meier curve.

12th week:
Lecture: Biostatistics final test.

Requirements

1. The aim of the course, short description of the subject
To give an introduction to biostatistical methods, which can be used in different branches of medicine to solve biostatistical problems and to evaluate experimental results. In addition to providing a solid theoretical foundation the course will also introduce the students to the art and science of performing the simplest calculations.

2. Short description of the subject
Brief introduction to the most basic concepts of statistics (set theory, probability, counting techniques). Descriptive statistics. Statistical distributions and their properties; binomial, Poisson and normal distributions. Sampling techniques and characterization of samples; central limit theorem. Hypothesis testing (z, t, F tests). Screening tests and epidemiologic investigations in medicine. All material covered in lectures is an integral part of the subject and therefore included in the final exam. In the classes, students are encouraged to ask questions related to the topic of the lectures discussed.

3. Requirements for the Biostatistics course
Attendance to classes is mandatory. Students must not miss more than one (1) class. No kind of certificates, including a medical certificate, are accepted for the absences. Making up for missed classes is not possible.

4. Requirements for signing the lecture book
Signing of the lecture book is denied if there are more than one (1) absences from group wise classes.

5. Course test
Students will write a grade-offering course test after the last seminar. Writing the grade-offering course test is not compulsory but recommended. The structure of this test will be identical to that of the final exam. A grade of pass (2) or better achieved on the grade-offering test is valid for the final exam.

6. Final exam
Students must take a written exam. Exams will be held once every two weeks during the exam period. The structure of the final exam: theoretical questions (true or false questions, multiple choice ques-tion, fill-in questions, open-ended questions) and calculations. A maximum 100 points can be obtained in the test. Based on the final score of the exam the following grades are offered:

- FS<50 fail (1)

- 50≤FS<65 pass (2)
- 65≤FS<75 satisfactory (3)
- 75≤FS<85 good (4)
- 85>=FS excellent (5)

7. Compulsory reading
Educational material published on the eLearning page of the course can be downloaded in pdf format (elearning.med.unideb.hu – Department of Biophysics and Cell Biology–English Courses–2nd semester).

8. Recommended reading
Wayne W. Daniel: Biostatistics, A foundation for Analysis in the Health Sciences, John Wiley&Sons

9. Exemptions
Applications for exemption from the biostatistics course has to be turned in to the Credit Transfer Committee via the Neptun system or the Educational Office. Such requests are not accepted by the Biomathematics Division or the Department of Biophysics and Cell Biology.

10. Information for repeaters
For repeaters the attendance on seminars is not compulsory. According to the relevant rules self-control tests may be written and exemptions may be obtained again.

11. Rules for C-chance exams
If the result of the written part of a C-chance exam is at least a pass (2) according to the rules pertaining to A- and B-chance exams, the grade of the C-chance exam will be what is to be offered based on the rules of the A- and B-chance exams. If the result of a C-chance exam is a fail, the written part will be followed by an oral exam. In this case the grade of the C-chance exam will be determined by the result of the written test and the performance on the oral exam.

Division of Cell Biology

Subject: **CELL BIOLOGY**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Lecture 1: Introduction. Origin of life. Prokaryotes and eukaryotes
Lecture 2: Cell membrane. Membrane transport

2nd week:
Lecture: Lecture 1: ABC transporters and related diseases
Lecture 2:Ion channels, membrane potential

3rd week:
Lecture: Lecture 1: Cell organelles. Overview of intrcellular transport processes
Lecture 2: Intracellular membrane systems I: lysosome, peroxisome, endoplasmic reticulum

4th week:
Lecture: Lecture 1: Intracellular membrane systems II: The Golgi complex, endo- and exocytosis, protein sorting

Lecture 2: Nuclear envelope. Transport through nuclear pores

5th week:
Lecture: Lecture 1: Cytoskeleton I: microtubules
Lecture 2: Cytoskeleton II: intermedier filaments, actin cytoskeleton

6th week:
Lecture: Lecture 1: Cell-cell and cell-matrix contacts
Lecture 2:Cellular energetics, mitochondrion

7th week:
Lecture: Lecture 1: Calcium homeostasis
Lecture 2:Osmo-, volume and pH regulation
8th week:
Lecture: Lecture 1: Nucleus, Chromatin
Lecture 2:Cell division cycle

9th week:
Lecture: Lecture 1: Mechanics of the cell cycle
Lecture 2: Regulation of the cell cycle

10th week:
Lecture: Lecture 1: Cell signaling I. General concepts. Nuclear receptors. G-protein coupled receptors
Lecture 2: Cell signaling II. Receptor tyrosine kinases. The Ras/MAPK, PI3K/Akt and PLC/CaMK pathways

11th week:
Lecture: Lecture 1: Cell signaling III. Pathways to the nucleus
Lecture 2: Cell-cell communication in the nervous and the immune system

12th week:
Lecture: Lecture 1:Cell fates. Differentiation.
Lecture 2: Oncogenes. tumor cells

13th week:
Lecture: Lecture 1: Cell senescence, apoptosis
Lecture 2: Stem cells

14th week:
Lecture: Lecture 1: From genes to cell function: overview of the main regulatory mechanisms.
Lecture 2: Cell motility

Requirements

Department: Department of Biophysics and Cell Biology, Cell Biology Division
Recommended semester: 1st year 2nd semester.
Prerequisites of the course: No prerequisites.
Teaching staff: Prof. Dr. György Vereb and the members of the Department
Education manager: Enikő Nizsalóczki (e-mail: cellbioedu@med.unideb.hu)

Aims of the course: The course gives an overview of the functional anatomy of higher eukaryotic animal cells with examples of the paradigmatic molecular mechanisms. Students successfully com-pleting the course will have acquired an active professional vocabulary minimally required for study-ing biochemistry, molecular biology, genetics, histology and physiology. In addition, the course aims to provide a thorough knowledge base which serves to understand the functions and dysfunc-tions of the human body in their broader context.

Course synopsis: Structure and constituents of eukaryotic cells, the most important cellular functions: membrane transport, vesicular transport, cell signalling, cell division (mitosis, meiosis), differentiation, cell death

Material to be studied:
Compulsory sources: 4th ed. of Essential Cell Biology (Alberts et al.,Garland Publ Inc. 2014. ISBN:

978-0-8153-4454-4). Chapters 1 and 11 through 20 are studied in depth during the course. Chapters 2 through 10 contain explanations for basic molecular concepts. There is additional core material that is available only in the lectures.

Cell biology Lab Notes: the currently required, up-to-date version is available at the course home page (@ elearning.unideb.hu).

Recommended: The in depth full-text version of the course material can be found in:
Lodish et al.: MOLECULAR CELL BIOLOGY, 7th edition, W. H. Freeman, 2013, ISBN-13: 978-1-4292-3413-9; Alberts et al.: MOLECULAR BIOLOGY OF THE CELL; 6th edition, Garland Publ. Inc., 2015, ISBN 978-0-8153-4453-7;
The 4th editions of these are also available online:
http://www.ncbi.nlm.nih.gov/books/NBK21475/
http://www.ncbi.nlm.nih.gov/books/NBK21054/

Knowledge that will be examined in this course is comprised in the slides presented in the lectures. It is recommended to download these slides before the lectures and take notes on them during the lecture. Slides of central importance will be marked accordingly.

Course home page: https://biophys.med.unideb.hu/en/node/635
https://elearning.med.unideb.hu/course/view.php?id=1171

Type of exam: Final exam

Exemptions: In order to get exemption from the complete Cell Biology course, the student has to apply to the Education Office. Applications for exemption from part of the courses are handled by the Department. The deadline for such applications is Monday on the second week of education. No application will be considered after this date. The following documents have to be submitted to the Educational Advisor: 1. application with an explanation why the student thinks that he/she is eligible for an exemption; 2. certificates about the courses the student has taken; 3. a reliable description of the curriculum of the courses taken. Applicants may be interviewed before the decision is made.

Requirements:
1. Lectures: Attendance of lectures is indispensable for acquiring the knowledge required to pass, understanding which parts of the material have the highest importance, and finding the proper sources for preparing for the exam.

2. Seminars: Seminars serve to discuss the lecture material. Use them well, study the material before the seminar and arrive with your questions. Attending the seminars is not compulsory but highly recommended. Students may sign up for one short interactive presentation during the semester. The teacher will choose the topic/questions on the spot and the presenter is required to pick the appropriate lecture slides and use them explain the topic. This requires the in depth knowledge of all the topics presented at the lectures and studying the relevant textbook chapters. The presentations are 5-15 min in length and are graded on a scale of 0-5. This grade counts toward the bonus points earned during the semester.

3. Labs: Labs are done under a separate subject code and need to be passed for acquiring a signature in for this course.

4. Self-control Tests (SCT-s):
There will be at least two SCT-s. The dates and topics (covering roughly the whole material) for SCT-s are announced in the beginning of the semester. Test and essay questions are scored on a 0-100% scale, averaged for the SCTs (=SCTave) and this average is used for offering exemptions and bonus points towards the final grade (see 5.2 and 5.4.1.). Similarly to the final exam, basic questions (on minimally required knowledge, part A) and in depth questions (part B) constitute the SCT. As opposed to the final exam, both A and B parts are evaluated in SCTs and contribute to the SCT score regardless of their value.
Writing the SCTs is not compulsory; SCTs cannot be made up for, even in the case of a justified absence. Missed SCTs contribute a score of 0 towards SCTave.
There will also be at least two self-control tests that can be completed at pre-defined times on eLearning system. The average score of these tests will be converted into bonus points and used when determining offered grades (see 5.4.1). Exact dates and topics for these electronic tests will be announced at the lecturesduring the semester.

5. Final Exam (written):

5.1. Parts of the Final Exam. The exam is a written test of two parts (A and B).
Part A of the written test is a minimum level test. It consists of a set of 10 true-or-false questions about basic cell biology knowledge (1 point each) and 5 questions asking for a brief description of basic terms (molecules, concepts). These terms are listed among the key-words published on the subject's website. The answers are scored on a 0-2 scale in increments of 0.5 points. The student has to score 16 or above out of the total 20 points in part A to pass. Below 16 points the grade of the exam is a fail (1) and part B is not marked (except C and last chance exams, see 5.5.). For writing Part A, 20 minutes are allocated. A successful passing of Part A (or exemption from writing Part A, see 5.4.2) is valid for B and C exams throughout the given exam period, but not in consecutive semesters.
Part B is a 90 minute complex written exam, including short essays (~20-25% of the total score), fill-in, short answer, multiple choice, relation analysis, sketch-recognition as well as simple choice and yes-or-no questions.

5.2. Calculating the exam score. As per 5.1., exam score is only calculated if Part A is passed.
1. % result of Part B expressed as points 100 points maximum

If score on Part B is greater or equal to 50%, the fol-lowing bonus points are added to the score of Part B:

2. Presentation grade5 points maximum
3. Average % result of SCTs (SCTave)
4 points for reaching 30%, +1 for each additional 10% reached10points maximum
Total:115 points maximum
N.B. Bonuses are only valid in the semester they were obtained.

5.3. Assigning grades to exam scores

Part A below 16 points: fail (1)

Exam score (see 5.2.):
below 60 points: fail (1)

60-69 points: pass (2)
70-79 points: satisfactory (3)
80-89 points: good (4)
reaching, and above 90 points: excellent (5)

5.4. Exemptions

5.4.1. For those who achieve SCTave >=50% at the self-control tests, a final grade offering score is calculated as follows:

1. SCTave % expressed as points 100 points maximum
2. Presentation grade5 points maximum
3. Average % result of eLearning self control tests
4 points for reaching 30%, +1 for each additional 10% reached 10points maximum
Total:115 points maximum

Grades are offered as listed under ”5.3. Assigning grades to exam scores”. (Part A is considered to be passed in this case without writing a Part A test.)

5.4.2. Those who achieve SCTave >=66% at the self-control tests and do not accept the offered grade calculated as under 5.4.1. and therefore take the final exam, are exempted from Part A of the written final exam during the given semester.

5.5. “C” chance and last chance exams

At ”C” and last chance exams if the score on Part A is 16 or above, and the exam score is 60 or above, grades are assigned as usual (see 5.3.). However, if Part A is failed, Part B will nevertheless be marked. A failed written exam is followed by an oral exam and the final grade is determined from comprehensive evaluation of the written and oral parts.

6. Rules for repeating the course

6.1. Repeaters taking again a regular Cell Biology course need to attend seminars and can do presentations as regulated normally (see 2.). We encourage repeaters to write the SCTs since this is the only way to receive bonuses and exemptions based on SCTave scores.

6.2. Repeaters can apply for a Cell Biology exam course in the third semester. The actual requirements for taking a Cell Biology exam course can be checked at the Department’s website:

CHAPTER 11
REQUIRED ELECTIVE COURSES

Department of Biochemistry and Molecular Biology

Subject: **GENE EXPRESSION REGULATION – FUNCTIONAL GENOMICS**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **14**
Seminar: **28**

1st week:
Lecture: Higher order regulation of eukaryotic gene expression.

2nd week:
Lecture: Experimental analysis of gene expression regulation I. Reporter systems, transfection. Experimental design, normalization.
Self Control Test

3rd week:
Lecture: Experimental analysis of gene expression regulation II. Detection of transcription factor binding: EMSA, footprinting, DNase hypersensitivity assay, chromatin immunoprecipitation.
Self Control Test

4th week:
Lecture: Experimental analysis of gene expression regulation III. Promoter mapping.
Self Control Test

5th week:
Lecture: Manipulation of gene expression. Expression of recombinant proteins. Protein-interaction based gene expression analysis. Repressive anti-gene treatment.
Self Control Test

6th week:
Lecture: Global analysis of active chromatin. Next generation sequencing approaches. The ENCODE project.
Self Control Test

7th week:
Lecture: Real time quantitative PCR: basics and experimental design.

8th week:
Practical: RNA isolation from cell culture, spectrophotometric characterization of RNA. Reverse transcription. qPCR data analysis and interpretation.

9th week:
Practical: RNA-seq data analysis 1.

10th week:
Practical: RNA-seq data analysis 2.

11th week:
Practical: RNA-seq data analysis 3.

12th week:
Practical: RNA-seq data analysis

13th week:
Practical: RNA-seq data analysis

14th week:
Practical: Summary and discussion of the oral exam topics.

Requirements

Requirements for oral examination:

Participation in the obligatory lectures and practicals. Only one absence is accepted from the obligatory lectures - in case of more absences students will not be permitted to take the oral exam. Absences from the practicals are not accepted.

Weekly tests:
During the semester students have to write 5 tests addressing the curriculum of the lectures. The tests consist of essay questions, and by writing the 5 tests a total of maximum 50 points can be collected - this will constitute 50% of the final score for grading. Students may take one improvement test at the end of the semester, from the topic of their choice.

Practical topics:
Real time quantitative PCR - experimental design and data analysis. Next generation sequencing - RNA-seq data analysis using the Galaxy platform. Programming skills are not required. Hands-on data analysis will be done together at the practicals. Students will also be required to complete a data analysis project independently, and present their results at the oral exam.

Oral exam:
Topic of the oral exam will be the material covered during the practicals, plus the written practical report. A maximum of 50 points can be collected at the oral exam.

Grading:
Grades will be offered based on the points collected during the semester, plus the points given for the oral examination - a maximum of 100 points can be collected. The student's performance will be assessed on a five-grade scale: pass (grade 2): 60-69%; satisfactory (grade 3): 70-79%; good (grade 4): 80-89%; excellent (grade 5): 90-100%. The list of in-semester test topics and the oral exam topics will be posted on the Department homepage, together with the lecture slides (https://elearning.med.unideb.hu). Students may take one improvement exam per exam period.

Subject: **GENOMIC BIOINFORMATICS**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **14**
Practical: **28**

1st week:
Lecture: Molecular databases, primary sequence databases (EMBL, GenBank. Analysis of scientific publications.

Practical: Introduction to UNIX. Downloading from databases, analysis witn command line methods. Simple statistical analysis with UNIX commands.

2nd week:
Lecture: Similarity search methods. The BLAST program. Journal club. E

Practical: Usage of local command line BLAST programs. Database download, generating local BLAST databases. Different types of local BLAST searches, analysis of results.

3rd week:
Lecture: Theory and application of microarray technology. Journal club.

Practical: Downloading microarray data from the GEO and ArrayExpress databases. Analysis of raw microarray data with the Chipster

program.

4th week:
Lecture: Alignment methods for short reads generated by next generation sequencing. De novo genome assembly, Velvet and SOAP methods. Journal Club.

Practical: Downloading next generation sequencing data from the SRA and ENA databases. Alignement to reference genome with BWA and Bowtie, using the supercomputer. De novo genome assembly with Velvet and SOAP methods using the supercomputer.

5th week:
Lecture:
The ChIP-seq method. Journal Club.

Practical: Analysis of a ChIP-seq experiment on a local computer: from downloading the raw data to de novo motif finding

6th week:
Lecture:
RNA-seq, TSS-seq and TSS-exon-seq methods. Journal club.

Practical: Downloading and analysis of RNA-seq and TSS-seq raw data on local computer.

7th week:
Lecture:
The GWAS method. Understanding the causes of genetic disorders using SNP data.

Practical: Downloading and analysis of GWAS data

Requirements

During this interactive course students will learn about genomics technologies through key publications. We will discuss the most important primary databases, the usage of BLAST and other similarity searching programs, the genome sequencing approaches and technologies, the microarray methods and the next generation sequencing applications. For the practicals students will have access to a local UNIX server, will download and analyze publicly available data with command line programming.
Lecture attendance and active participation in the practicals is required.

Subject: **INTRODUCTION TO MOLECULAR MEDICINE**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **25**

1st week:
Lecture: Introduction to molecular medicine

2nd week:
Lecture: Genomic medicine

3rd week:
Lecture: Diabetes

4th week:
Lecture: Obesity

5th week:
Lecture: Vitamin D and immundefects

6th week:
Lecture: Cancer I.

7th week:
Lecture: Cancer II.

8th week:
Lecture: Cancer II.

9th week:
Lecture: Osteoporosis

10th week:
Lecture: Immunedeficiencies

Requirements

Course content:
Topics presented at the lectures (available at the website of the Department of Biochemistry and Molecular Biology,**).** Follow the link: Educational materials- Elective courses

Attendance:
Students are expected and required to attend all lectures of this course. No more than one unexcused absence is permitted. Students will fail the course on their second unexcused absence. Legitimate excuses should be presented in writing to the course administrator by the specified date.

Grading policy:
The final grade will be based on the final oral exam at the end of the semester. Students have to select one topic from the full list of course topics for their oral exam, and can sign up for the topic at the link below. The final sign-up sheet will be posted on the department web-site at the beginning of the exam period. **It will be your responsibility to contact the lecturer for the assignment, and for the date of the oral examination.** The course lecturers will assign scientific publications to the students based on the sign-up sheet. For the oral exam students are expected to prepare a short Powerpoint presentation (4-5 slides) based on the publication, and discuss the publication with the lecturer.
Please follow the **announcements** of the course administrator about exam dates or changes in the schedule on the bulletin board (LSB downstairs, 1corridor), and on the department

Subject: **PROTEOMICS**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **28**
Practical: **28**

1st week:
Lecture: Introduction to proteomics. Proteins: characterization, production, analysis, therapeutical uses.

2nd week:
Lecture: The role of proteomics in modern medicine

3rd week:
Lecture: The basics of mass spectrometry

4th week:
Lecture: Protein sequencing
5th week:
Lecture: Databases for proteomics

6th week:
Lecture: Purification of proteins

7th week:
Lecture: Analysis of proteins

8th week:
Lecture: Analysis of protein-protein interactions

9th week:
Lecture: Identification of biomarkers by mass spectrometry. Targeted validation of biomarkers by proteomics.

10th week:
Lecture: Analysis and characterization of protein structure. Identification of post-translational modifications.

11th week:
Lecture: Quantifying proteins. Quantitative proteomics.

12th week:
Lecture: Production and utilization of therapeutical proteins.

13th week:
Practical: Transformation of competent cells with plasmid vector. Production of recombinant proteins - an overview. Vector selection, construction of a restriction map with NEBCutter. Selection of host system. Vector preparation, primer design (basics and hands-on excercise) with the QuickChange software.

14th week:
Practical: Bacterial culture and induction with IPTG. Mass spectrometry - demonstration. Introduction to the Voyager DEPRO MALDI-TOF (Applied Biosystems) and Agilent 1100 HPLC-linked 4000 QTRAP (Applied Biosystems) systems. Basics of mass spectrometry and data analysis. Protein purification from bacteria. Data analysis and interpretation.

Requirements

Aims:
The course enlarges the knowledge of the students making them able to work on the specific field of proteomics. They will be able to understand proteomics data, to design proteomics experiments and by acquiring practical knowledge, the students will be able to work in proteomics labs, to carry out proteomics experiments, to do innovative proteomics research and to continue their studies at PhD level.

Subject description:
During the course the students will get knowledge about the basics of proteomics, the gel- and mass spectrometry-based methods which make possible the identification and quantification of proteins and to detect the post-translational modifications. The practicals are in accordance with the lecture materials and the students can learn in practice the most important and critical steps of sample prepartion and the major criteria of data analysis.

Schedule of the lectures:
Introduction to proteomics – Why do we need proteomics? What kind of data proteomics can and cannot provide?
Basics of liquid chromatography
Basics of mass spectrometry
Protein identification using mass spectrometry. Peptide sequencing, data interpretation
Targeted proteomics (SRM/MRM, PRM), data dependent and data independent analysis (DDA, DIA)
Quantitative proteomics (iTRAQ, SILAC, label-free quantification, SRM, PRM)
Detection of post-translational modifications using mass spectrometry. Sample preparation strategies, specific enrichment
Two dimensional electrophoresis
Proteobioinformatics
Protein purification strategies

The study of protein-protein interactions
Biomarker identification and validation using mass spectrometry
Preparation and use of protein therapeutic agents. The role of mass spectrometry in quality control
Consultation

Practice:
On three consecutive days at the end of the semester.
Day 1: 10 hours

4 hours: SDS-PAGE separation of protein mixtures. Gel staining with Coomassie dye.
1 hour: Scanning of Coomassie stained gels.
5 hours: Excising and destaining of gel bands, in-gel trypsin digestion.

Day 2: 10 hours
3 hours: Extracting the digested peptides from the gels.
6 hours: In-solution trypsin digestion of protein mixtures.
1 hour: Desalting of in-solution digested samples with C18 resin-containing tips

Day 3: 10 hours
3 hours: Mass spectrometry (demonstration).
Introduction to mass spectrometers located in the Proteomics Core Facility. Demonstration of sample injection techniques.
3 hours: Mass spectrometry data analysis. Analysis of MS/MS data with the MASCOT search engine. Analysis of MS/MS data with the ProteinPilot software (demonstration). Basics of mass spectrometry data interpretation.
4 hours: Basics of SRM assay design. SRM data analysis with the Skyline software.

Subject: **STRUCTURE AND FUNCTION OF MACROMOLECULES**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Lecture: **14**
Practical: **30**

1st week:
Lecture:
1-2. Theoretical approaches in biochemistry. Principles of protein folding. Evolution of proteins.
Practical:
1. Introduction to the Pymol programme
Installation of Pymol, reading a PDBfile, selection, representation, determination the chain orientation, representation of the surface residues.

2nd week:
Lecture:
3-4. Basis of protein structure and design. Properties of amino acids. Analysis and design of secondary structures.
Practical:
2. Visualisation of molecules
Different representations, backbone display, determination ofconformational parameters of the peptide chain. Analysis of helical structures, orientation of helix dipoles, interaction between helices.

3rd week:
Lecture:
4-5. Interactions between secondary structures. Generation of different domain types. Structure databases.

Practical:
3. Supersecondary structures
Analysis of the Ramachandran map. Studying the ROP protein: orientation and interaction between secondary structures, the roles of heteroatoms. Analysis of tropomyosin repeats, analysis of coiled coils. Interaction pattern, origin of stability.

4th week:
Lecture:
6-7. Experimental techniques of structure determination and analysis. Structure-function relationships.
Practical:
4. Tertiary structures of proteins. All alpha structures
Searching for helical domains. The structure of myoglobin. Analysis of porphyrin structure. The structure of hemoglobin. Allosteric communication between the subunits. Potential pathways of oxigen binding. Comparative analysis of hemoglobin structures. Superposition of hemoglobin structures from different organisms.

5th week:
Lecture:
8-9. Prediction of tertiary protein structures. Homology modeling. Loop-design.

Practical:
5. Alpha/beta domain structures I
The structure of the alpha-amylase. Analysis of helix and strand topology. Localization of the active site. Representation of the ligand, analysis of ligand binding. Searching for enzymes with similar structures. Evolutionary analysis of similar alpha/beta domain structures. Superposition of other domains.

6th week:
Lecture:
10-11. Structure of nucleic acids. DNA-protein interactions. DNA recognition motifs and structural elements.

Practical:
6. Alpha/beta domain structures II
The structure of flavodoxin. Secondary structure prediction for flavodoxin sequence and comparison with the observed structural elements. Analysis of beta strands in terms of localization, orientation and hydrogen bonding pattern. Studying the geometry of the connecting loop. Searching for similar structures, superposition.

7th week:
Lecture:
12-13. Enzymatic catalysis.
Practical:
7. All beta structures
Hydrogen bonding pattern and characteristic residues in parallel and anti-parallel beta strands. Analysis of retinol binding protein. Analysis and categorization of beta turns. The greek key motif, studying the gamma-crystallin structure. Analysis of the beta strands in the ErbB receptor.

8th week:
Lecture:
14-15. Experiment design. Docking, amino acid replacements. Interpretation of experiments.
Practical:
8. Transmembrane proteins
Analysis of the photosynthetic reaction center. Display of the different chains, selection of those, which are located in themembrane. Determination of the secondary structures, topology and membrane interactions. Determination of polar and apolar surfaces, and their positions wit respect to the membrane. Representation of chlorophyll molecules and their location with respect to secondary structures.

9th week:
Practical:
9. Analysis of transmembrane structures.
Prediction of G-protein coupled receptors. Prediction of transmembrane protein segments based on secondary structure predictions and analysis of hydrophobicity profiles. Analysis of pore forming proteins (Omp). Analysis of the inner and outer surface of the pore. Mutations affecting selectivity or stability. The strutcure of bacteriorhodopsin.

10th week:
Practical:
10. Pancrease lipase
Structural basis of the molecular mechanisms, which were introduced in biochemistry and molecular biology courses. Analysis of domain structure in free and ligand-bound forms. Interactions of the ligand binding loop with the domain interfaces and its movement during enzymatic activity. Interactions of the colipase.

11th week:
Practical:
11. Specificity of enzymes
Comparative analysis of trypsin and chymotrypsin. Superposition of structures. Analysis of active sites and substrate-binding pockets. Functional consequences of the different architectures. Specific and cross-docking of ligands. Active sites of aspartyl proteinases, potential catalytic mechanism.

12th week:
Practical:
12. DNA structures
A, B, Z DNA structures. Analysis of differences in the hydrogen bonding pattern and stacking interactions. Structural consequences of DNA lesions, analysis of a thymine dimer. The structure of the Holliday-junction and its biological role.

13th week:
Practical:
13. RNS structures.
Typical secondary structures in RNA. Localization of Mg ions and their interactions with the different structural elements of RNA. Analysis of t-RNA szerkezetének structure. The structure of the ribozyme and basis of catalysis.

14th week:
Practical:
14. DNA - protein interactions.
Analysis of typical DNA recognition motifs: helix-turn-helix, leucin zipper, Zn-finger, Ig-fold. Distortion of DNA upon binding to TBP or CAP. DNA recognition by disordered proteins, the LEF-1 transcription factor.
15. Consultation, discussion of homeworks.

Requirements

Goals: Design and interpretation of the biochemical and molecular biology experiments. Insights into the structure and function of proteins and nucleic acids, using physical principles.
Short description: Understanding and design of biomolecular structures. Experimental and computational methods for structure determination of biomolecules. Theoretical approaches to biochemical problems. Rational experimental design. Discussion of scientific papers, participation in scientific debates.
Material:
Literature:
Stryer: Biochemistry; A. Warshel: Computer modelling of chemical reactions in enzymes and solutions; A. Leach: Molecular modelling
Requirements of signature: Attendance of 80% of the lectures, 100% of practicals. Practical homeworks must be submitted and accepted.
Evalutaion during the semester: Practical homeworks.
Evaluation at the end of the semester: oral exam

Department of Medical Chemistry

Subject: **BIOCHEMISTRY PRACTICAL I.**
Year, Semester: 1st year/1st semester
Number of teaching hours:
Practical: **42**

Subject: **ENZYMOLOGY**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **10**
Practical: **42**

3rd week:
Lecture: Enzymes, as biological catalysts. Michaelis-Menten kinetics.

4th week:
Lecture: Inhibition of enzyme activity. Competitive, noncompetitive, uncompetitive, and mixed types of inhibitors.
Practical: Enzymes of lipid and hydrogen peroxide degradation

5th week:
Lecture: Methods for the determination of enzyme activity. Environmental factors, stability and interfering substances affecting the enzyme assays.
Practical: Proteases

6th week:
Lecture: Enzyme regulation. Allosteric and covalent controls of enzyme activity. The kinetics of allosteric enzymes.
Practical: Transaminases

7th week:
Lecture: Supramolecular enzyme organization. Multienzyme complexes and conjugates. Protein complexes, and compartmentalization.
Practical: Transglutaminases

8th week:
Lecture: β-galactosidase.

9th week:
Practical: Experiments withb-D-glucosidase

10th week:
Lecture: Mitochondrial metabolism
Practical: Glycogen phosphorylase

11th week:
Lecture: Glycogen phosphorylase

12th week:
Lecture: Phosphorylase kinase
Practical: Phosphorylase kinase

14th week:
Practical: Practical exam

Requirements

Elective course recommended for the students of the genomics and biochemistry module. Limit of the participants: max. 10 students/semester. Exam: ESE (written test including theoretical and practical questions). The successful completion of the practical classes is a pre-requirement. The exam cannot be started in the absence of the signatures of all practical instructors at the back page.

Subject: **POST-TRANSLATIONAL MODIFICATION OF PROTEINS**
Year, Semester: 2nd year/2nd semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture:
Introduction to posttranslational modifications.

2nd week:
Lecture: Protein phosphorylation. Serine/threonine-specific protein kinases.

3rd week:
Lecture: Dephosphorylation of proteins. Serine/threonine protein phosphatases.

4th week:
Lecture: Protein phosphorylation on tyrosine side chains: tyrosine kinases and phosphatases.

5th week:
Lecture: Proteolysis: types and catalytic mechanisms of proteolytic enzymes.

6th week:
Lecture: Role of proteinases in the regulation of cellular functions. Ubiquitination of proteins.

7th week:
Lecture: Modification of proteins on cysteine residues.

8th week:
Lecture: Lipid modifications of proteins. Protein hydroxylation.

9th week:
Lecture: Glycosylation of proteins.

10th week:
Lecture: Acetylation and methylation of proteins. Epigenetics and histone modifications.

11th week:
Lecture: Protein mono-ADP-ribosylation.

12th week:
Lecture: ROS/RNS-induced posttranslational modifications: focus on poly-ADP-ribosylation.

13th week:
Lecture: Protein carboxylation and amidation. Transglutaminases.

14th week:
Lecture: Review of posttranslational modifications.

Requirements

The aim of this course is to provide students with specific professional knowledge and understanding the aspects of postsynthetic protein modifications. The program consists of lectures. Attendance at the lectures is highly recommended. The End of Semester Examination is a written test containing two questions. The questions include the topics of all of the lectures. The knowledge of both questions at least at the basic level is required for the passing grade.

Materials are published on the web page.

Subject: **SIGNALLING PATHWAYS IN THE CELLS**
Year, Semester: 2nd year/1st semester
Number of teaching hours:
Lecture: **28**

1st week:
Lecture: Introduction.

2nd week:
Lecture: Overview of cell signalling mechanisms.

3rd week:
Lecture: Cell signalling pathways.

4th week:
Lecture: Ion channels.

5th week:
Lecture: Sensors and effectors.

6th week:
Lecture: Off mechanisms

7th week:
Lecture: Spatial and temporal aspects of signalling

8th week:
Lecture: Cellular processes

9th week:
Lecture: Development

10th week:
Lecture: Cell cycle and proliferation

11th week:
Lecture: Cell stress, inflammatory responses and cell death

12th week:
Lecture: Neuronal signalling

13th week:
Lecture: Signalling defects and diseases

14th week:
Lecture: Students' presentations: novel mechanisms in signalling

Requirements

The program consists of lectures. Attendance of the lectures is required and recorded. Evaluation of the student's performance at the end of semester examination includes the quality of student's presentation and the score of a written examination in which questions cover all topics. Improvement of the examination mark is possible by oral examination.

Division of Cell Biology

Subject: **CELL BIOLOGY PRACTICE**
Year, Semester: 1st year/2nd semester
Number of teaching hours:
Practical: **15**

3rd week:
Practical: Cell types and basic constituents: separation and staining of blood cells

5th week:
Practical: Membrane transport: multidrog resistance

7th week:
Practical: Homeostasis: cell viability and death

9th week:
Practical: Cell morphology, subcellular structures: fluorescent visualization

11th week:
Practical: Cell signalling: in situ observation

13th week:
Practical: Remedial lab

Requirements

Department: Department of Biophysics and Cell Biology
Recommended semester: 1st year 2nd semester.
Semester for the regular course: 1st.
Prerequisites of the course: No prerequisites.
Teaching staff: Dr. Katalin Goda and members of the Department
Course coordinator: Zsolt Fazekas (e-mail: fzsolt@med.unideb.hu)
Education manager: Enikő Nizsalóczki (e-mail: cellbioedu@med.unideb.hu)

Aims of the course: This is a practical course where students can learn the most important cell biol-ogy laboratory skills. Students work in small sub-groups (4-6 students per sub-group).

Material to be studied:
Cell biology Lab Notes: the currently required, up-to-date version is available at the course home page on the eLearning site.
Relevant parts of the Cell Biology Lecture course (see there).

Course home page: https://biophys.med.unideb.hu/, elearning.med.unideb.hu

Signature: Signing for the course can be denied if the student has not performed all the lab practices or any one of the lab logs has not been accepted.

Type of exam: Practical grade

Requirements:
Completing all labs, and writing up the results and their interpretation in a lab log book on the spot is required. Only handwritten, bound lab log books are acceptable. The compulsory preparation for the lab includes writing the aims of the lab and the methods of implementation into the lab logbook before the lab. During the lab a log must be written into the book in a way that allows reproducing the work done. So it must document what the student has actually done, the results obtained (including graphs and color drawings), and their interpretation. The lab tutor will only sign the log up-on proper, independent completion of the lab. All labs must be accepted by a valid signature in order to receive the end of term signature.
Labs can only be performed by students who arrive well prepared. This is checked by a ~10 min test at the beginning of the lab, graded on a scale of 0-5 according to the following table:

Number of correct answers	Test Points (TP)
less than 5	0
5	1
6	2
7	3
8	4
9-10	5

A TP of 0 results automatically in dismissal from the lab. Furthermore, if the student's participation in the lab is not acceptable, the lab tutor will dismiss the student from the lab immediately, and the lab will be considered failed.
TP ≥1 are averaged and, after rounding, yield the final practical grade. If the average of the TP is below 1.5, it results in a practical grade 1 (fail). In these cases, a written lab exam can be done for the pass (2) mark before the exam period (covering the topics of all labs).
The practical grade cannot be improved in the exam period.
Since all labs must be accepted in order to receive the end of term signature (and a practical grade), those missing a lab are offered one (1) extra occasion to make up for the missed lab during the remedial week. This offer includes both the cases of writing a lab test of grade 0 earlier, and labs missed because of certified illness. In the latter case, certificates must be filed with the Education coordinator in Office Hours at the earliest possible occasion, so the student can be assigned a remedial lab appointment.

CHAPTER 12
TITLES OF THESES

Department of Anatomy, Histology and Embryology

1. Title: Possible applications of morphofunctional matrices for classification of neurons (computer modelling)
Tutor: Ervin Wolf M.Sc., Ph.D.

2. Title: Correlation analysis of functional brain maps
3. Title: Investigation of contour integration processing in the primary visual cortex using voltage sensitive dye imaging
Tutor: Zoltán Kisvárday M.Sc., Ph.D., D.Sc.

4. Title: Investigation of signalling mechanisms that regulate cartilage development and maturation
Tutor: Róza Zákány M.D., Ph.D.

5. Title: Interrogation of spinal dorsal horn circuits with electrophysiological and optogenetic tools
6. Title: Light- and electron microscopy level analysis of the axons and axon collaterals of spinal lamina I projection neurons
7. Title: Local synaptic connections of projection neurons in spinal lamina I
8. Title: Morphometric analysis of excitatory and inhibitory interneurons in the spinal dorsal horn
Tutor: Péter Szücs M.D., Ph.D.

9. Title: Extracellular matrix in the developing brainstem
Tutor: Ildikó Wéber M.Sc., Ph.D.

10. Title: Matrix metalloproteases in vestibular lesion
Tutor: Botond Gaál M.Sc., Ph.D.

11. Title: Investigation of neuronal network development in the spinal cord
Tutor: Zoltán Mészár M.Sc., Ph.D.

12. Title: The role of the molecular clock in healthy and osteoarthritic chondrocytes
Tutor: Csaba Matta M.Sc., Ph.D.

13. Title: Role of PACAP signalling in cartilage differentiation and regeneration
Tutor: Tamás Juhász M.Sc., Ph.D.

14. Title: Distribution of the extracellular matrix in the red nucleus and pararubral area
Tutor: Éva Rácz M.Sc., Ph.D.

15. Title: The endocannabinoid-mediated modulation of spinal nociception
16. Title: The role of astrocytes in spinal pain processing
Tutor: Zoltán Hegyi M.Sc., Ph.D.

17. Title: Quantitative morphological studies of primary afferent-motoneuron connections in the frog's brainstem
Tutor: András Birinyi M.Sc., Ph.D.

18. Title: Role of pro-inflammatory cytokines in neuron-glia interaction during inflammatory pain states
Tutor: Krisztina Holló M.Sc., Ph.D.

19. Title: Mapping of synapses on dendrites of GABAergic neuron subtypes in the cerebral cortex
Tutor: Petra Talapka Ph.D.

Department of Biochemistry and Molecular Biology

1. Title: Dissecting and aligning the regulatory and effector mechanisms shaping murine M2 macrophages
2. Title: Dissecting the transcriptional network allowing macrophages to control angiogenesis
3. Title: The role of the transcription factor BACH1 in macrophage function and tissue homeostasis
Tutor: László Nagy M.D., Ph.D., M.H.A.Sc.

4. Title: The role of retroviral proteases in the retroviral life cycle.
Tutor: József Tőzsér M.Sc., Ph.D., D.Sc.

5. Title: The role of tissue transglutaminase in rolling and adhesion of neutrophil granulocytes
Tutor: Zoltán Balajthy M.Sc., Ph.D.

6. Title: Saliva biomarkers of oral cancer.
Tutor: Beáta Scholtz M.Sc., Ph.D.

7. Title: Production of dendritic cells and macrophages from embryonic stem cells.
8. Title: Transcriptional reprogramming of murine embryonic stem cell progenitors.
Tutor: István Szatmári M.Sc., Ph.D.

9. Title: Studies in the regulation of tissue specific and cancer specific gene expression by using genomic and bioinformatic tools
Tutor: László Bálint Bálint M.D., Ph.D.

10. Title: Effects of various coeliac autoantibodies on transglutaminase 2 activities and interactome.
11. Title: Modification of the enzymatic activity of transglutaminase 2 by site-directed mutagenesis. Therapeutic utilization of modified transglutaminase 2.
12. Title: Studying structure and function relationship of transglutaminases and its application in translational medicine
Tutor: Róbert Király M.Sc., Ph.D.

13. Title: Quantitative proteomic analysis of the tear proteins of diabetic patients.
Tutor: Éva Csősz M.Sc., Ph.D.

14. Title: Evaluation of the browning potential and inducibility from human fat tissue biopsies
Tutor: Mária Szatmári-Tóth M.Sc., Ph.D.

15. Title: Identification of regulatory SNPs in promoter regions of different species by bioinformatic analyses.
Tutor: Endre Barta M.Sc., Ph.D.

16. Title: Alterations in structural properties of the transcription machinery in relation to disease development
17. Title: Drug discovery for protein interactions
18. Title: Functional aggregation in innate immunity
19. Title: Molecular factors in cell differentiation
20. Title: New comparative methods of protein evolution and sequence analysis
21. Title: Regulation of protein half-life via protein interactions
22. Title: Studying the re-programming mechanisms of viral proteins.
23. Title: The role of signalling pathway perturbations in cancer development
Tutor: Mónika Fuxreiter M.Sc., Ph.D., D.Sc.

24. Title: Characterization of adipocytes with thermogenic potential
25. Title: In vitro study about the effect of environmental conditions (e.g.: temperature, oxygen availability) on the differentiation potential and beigeing process of primary adipocytes
26. Title: Investigation of the beigeing plasticity of adipocytes, identification of key extrinsic and intrinsic factors
Tutor: Beáta Bartáné Tóth M.Sc., Ph.D.

27. Title: Investigation of novel molecular elements of the browning machinery in different human adipose tissues
28. Title: Investigation of the biological significance of “batokine” secretion in human cell models
Tutor: Endre Károly Kristóf M.D.

29. Title: Characterization of genetic risk factors of chronic pancreatitis
Tutor: András Szabó M.Sc., Ph.D.

Department of Biophysics and Cell Biology

1. Title: Investigation of cell surface distribution of erbB-2 oncoprotein in breast tumor cell lines
2. Title: Role of tumor stem cells in trastazumab resistant breast tumors
Tutor: János Szöllősi M.Sc., Ph.D., D.Sc., M.H.A.Sc.

3. Title: Studying the inactivation of voltage gated potassium ion channels in heterologous expression systems
Tutor: György Panyi M.D., Ph.D., D.Sc.

4. Title: Epigenetic regulation of nucleosome-DNA cohesion
Tutor: Gábor Szabó M.D., Ph.D., D.Sc.

5. Title: Mathematical analysis and computer modelling of the topology of cell surface proteins
6. Title: Role of MHC in the organization of cell surface proteins
Tutor: László Mátyus M.D., Ph.D., D.Sc.

7. Title: Cytometry of cytotoxic lymphocytes
8. Title: Physiological roles of the multidrug resistance transporter P-glycoprotein
Tutor: Zsolt Bacsó M.D., Ph.D.

9. Title: Elucidation of the catalytic mechanism of ABC transporters
Tutor: Katalin Goda M.Sc., Ph.D.

10. Title: Development of machine learning-based methods for identification of cellular components
11. Title: Effect of the lipid composition of the cell membrane on membrane protein clustering and on cell biological processes related to the cell membrane
12. Title: Role of changes in the dynamic properties of the cell membrane in the protective role of methane against hypoxia-reperfusion injury
Tutor: Péter Nagy M.D., Ph.D., D.Sc.

13. Title: Membrane biophysical and cell biological effects of cyclodextrins
14. Title: The role of the Hv1 proton channel in vascular smooth muscle cells
Tutor: Zoltán Varga M.Sc., Ph.D., D.Sc.

15. Title: Biophysical analysis and functional significance of cell surface protein patterns in T cell-mediated immune responses
Tutor: Andrea Dóczy-Bodnár M.Sc., Ph.D.

16. Title: Ligand depedence of nuclear receptor function studied by single molecule microsocpy
17. Title: Studying the function and interactions of interleukin-2 and -15 receptors by advanced microscopy
Tutor: György Vámosi M.Sc., Ph.D.

18. Title: Generating and characterizing multicomponent primary human cell cultures for transplantation therapy of stem cell deficient corneas
19. Title: Molecular interactions in histopathological diagnosis: applying FRET in a confocal fluorescence digital pathology slide scanner
20. Title: Optimizing reprogrammed, chimeric antigen receptor (CAR) -transduced human T cells for tumor therapy
21. Title: Role of receptor tyrosine kinases and integrins in the therapy resistance of tumors
Tutor: György Vereb M.D., Ph.D., D.Sc.

22. Title: Ion channel expression of engineered T cells used in cancer immunotherapy
23. Title: Ion channel expression of tumor inflitrating T cell populations
Tutor: Péter Hajdu M.Sc., Ph.D.

Department of Inorganic and Analytical Chemistry

1. Title: Application of citrate buffers in clinical analysis and diagnosis. (A literature survey)
Tutor: Imre Tóth D.Sc.

2. Title: Experimental methods for the study of redox properties of copper(II) complexes (A literature survey)
Tutor: Katalin Várnagy M.Sc., Ph.D., D.Sc.

3. Title: The role of oxidation of biomolecules by catalysation of metal ions in the development and onset of neurodegenerative disorders. (A literature survey)
Tutor: Csilla Kállay M.Sc., Ph.D.

Department of Botany

1. Title: Stress tolerance and resistance mechanisms of higher plants
Tutor: Ilona Mészáros M.Sc., Ph.D., C.Sc.

2. Title: The study of chromatin and microtubule organization in cells of higher plants
Tutor: Csaba Máthé M.Sc., Ph.D.
3. Title: Plant bioactive compounds
Tutor: Gábor Vasas M.Sc., Ph.D., D.Sc.

4. Title: Role of glycoproteins in infection and immunology (bibliographic)
Tutor: János Kerékgyártó M.Sc., Ph.D., C.Sc.

Division of Nuclear Medicine and Translational Imaging

1. Title: Development of interactive E-learning material for nuclear medicine
Tutor: József Varga M.Sc., Ph.D.

2. Title: Assessment of Diabetic Foot with Different Nuclear Medicine procedures
Tutor: Ildikó Garai M.D., Ph.D.

Division of Radiology and Imaging Science

1. Title: Analysis of Pediatric Radiology Examinations
Tutor: Nóra Vrancsik M.D.

Department of Medical Imaging

1. Title: Posttherapeutic I-131 whole body SPECT/CT in patients with thyroid cancer
2. Title: The role of Tc99m-Tektrotyd SPECT/CT to evaluate metastatic neuroendocrine tumors
Tutor: Ildikó Garai M.D., Ph.D.

3. Title: Localisation of anatomical regions of CT scans with machine learning methods
Tutor: Zoltán Barta M.D.

Department of Human Genetics

1. Title: Characterization of factor-C protein family using sequence databases.
2. Title: Study of a gene regulating differentiation in bacteria.
Tutor: Sándor Biró M.Sc., Ph.D., D.Sc.

3. Title: Analysis of mono-ADP-ribosylated proteins from pro- and eukaryotic cells.
Tutor: András Penyige M.Sc., Ph.D.

4. Title: Analysis of an A factor non-producer bald mutant Streptomyces griseus strain with respect of antibiotic production and cell differentiation.
Tutor: Zsuzsanna Birkó M.Sc., Ph.D.

5. Title: Study of mitochondrial copy number changes in glioblastoma.
Tutor: Judit Keserű M.Sc., Ph.D.

6. Title: miRNA-profiling of regressive Wilms' tumors.
7. Title: Studying the role of long non-coding RNAs in glioblastoma.
Tutor: Gergely Buglyó M.D., Ph.D.

8. Title: Functional analysis of the Streptomyces facC gene in Aspergillus
Tutor: Melinda Paholcsek M.Sc., Ph.D.

9. Title: Global analysis of the human blood plasma epitome and interactome in health and disease.
10. Title: Use of comparative monoclonal antibody proteomics to detect three dimensional conservation relevant to protein function.
Tutor: László Takács M.D., Ph.D., D.Sc., M.H.A.Sc.

11. Title: Exosomes, as possible biomarkers.
Tutor: Beáta Soltész M.Sc., Ph.D.

12. Title: Study the role of microRNAs in ovarian cancer.
Tutor: Melinda Szilágyi-Bónizs M.Sc., Ph.D.

13. Title: Cell-free nucleic acids as biomarkers in diagnosis of diseases.
14. Title: The role of non-coding RNAs in development of tumors.
Tutor: Bálint Nagy M.Sc., Ph.D. habil., D.Sc.

Department of Immunology

1. Title: The role of the HOFI/SH3PXD2B adaptor protein in the regulation of the tumor microenvironment
Tutor: Árpád Lányi M.Sc., Ph.D.

2. Title: The role of innate immune cells in the development of allergic responses
3. Title: The role of innate lympoid cells (ILC) in human diseases
Tutor: Attila Bácsi M.Sc., Ph.D.

4. Title: Altered differentiation of monocyte derived dendritic cells and their functional differences
Tutor: Péter Gogolák M.Sc., Ph.D.

5. Title: Investigation of phytocannabinoid effects on human monocyte-derived dendritic cells
6. Title: Investigation of transient receptor potential channels on human monocyte-derived dendritic cells
Tutor: Attila Szöllősi M.D., Ph.D.

7. Title: Identification of new viral senzors and new regulatory mechanisms in the antiviral responses of human dendritic cells
8. Title: Role of dendritic cells in the development of autoimmune diseases
Tutor: Kitti Pázmándi M.Sc., Ph.D.

9. Title: Study of non-apoptotic cytotoxic processes during immune response, new way of killing apoptosis resistant tumor cells
Tutor: Gábor Koncz M.Sc., Ph.D.

Department of Medical Chemistry

1. Title: Investigation of Ser/Thr protein phosphatase in pathogenic fungi
Tutor: Viktor Dombrádi M.Sc., Ph.D., D.Sc.

2. Title: Interaction of protein phosphatase 1 catalytic subunit with regulatory proteins
Tutor: Ferenc Erdődi M.Sc., Ph.D., D.Sc.

3. Title: Regulation of macrophage activation
Tutor: László Virág M.D., Ph.D., D.Sc.

4. Title: Signal transduction pathways in pulmonary endothelial cells
Tutor: Csilla Csortos M.Sc., Ph.D., D.Sc.

5. Title: Structural and functional investigation of a fungus specific protein phosphatase
Tutor: Ilona Farkas M.Sc., Ph.D.
6. Title: Study of metabolic processes with special regard to the involvement of mitochondrial activity.
Tutor: Péter Bay M.Sc., Ph.D., D.Sc.

7. Title: Application of High-Content Screening in Life Sciences
Tutor: Endre Kókai M.Sc., Ph.D.

8. Title: Signalling pathways in endome
9. Title: Study of the role of protein phosphatase in wound healing
Tutor: Beáta Lontay M.Sc., Ph.D.

10. Title: Inhibition of sodium-glucose cotransporter of kidney by glucose-based compounds also interfering with glycogenolysis
Tutor: Tibor Docsa M.Sc., Ph.D.

11. Title: Regulation of protein phosphatase-1 by inhibitory proteins and the translocation of the targing subunit
Tutor: Andrea Kiss M.Sc., Ph.D.

12. Title: High-Throughput Screening
Tutor: Csaba Hegedűs M.D., L.D.S., Ph.D.

13. Title: Autophagy in physiological and pathological processes
Tutor: Katalin Kovács M.Sc., Ph.D.

14. Title: Study of protein-protein interaction in the neurodegenerative Huntington's disease.
Tutor: Krisztina Tar M.Sc., Ph.D.

Department of Medical Microbiology

1. Title: Antimicrobial cell-mediated immunity measured by mRNA tests
Tutor: József Kónya Ph.D., D.Sc.

2. Title: Evaluation of in vitro efficacy of different new antibiotics against multiresistant bacteria
Tutor: Judit Szabó M.D., Ph.D.

3. Title: Role of HPV in head and neck cancers
Tutor: Krisztina Szarka M.Sc., Ph.D.

4. Title: Evaluation of fungicidal effect of antifungal agents using time-kill curves
5. Title: New and older agents in antifungal chemotherapy
Tutor: László Majoros M.D., Ph.D.

6. Title: Prevalance of human polyomaviruses
Tutor: Eszter Csoma M.Sc., Ph.D.

7. Title: Effects of human papillomavirus oncoproteins on cellular signaling pathways in keratinocytes
Tutor: Anita Szalmás M.Sc., Ph.D.

8. Title: Molecular epidemiology of aminoglycoside resistance in nosocomial Gram negative bacteria
Tutor: Gábor Kardos M.D., Ph.D.

9. Title: Intratypical variation of human papillomaviruses
Tutor: György Veress M.Sc., Ph.D.

10. Title: The importance of fungal quorum-sensing in antifungal therapy against Candida biofilms.
Tutor: Renátó Kovács M.Sc., Ph.D.

Department of Internal Medicine

1. Title: Immunotherapy of B cell lymphomas.
2. Title: Safety profile of prolonged rituximab therapy in lymphomas.
3. Title: Targeted therapy in non-Hodgkin's lymphomas
Tutor: Lajos Gergely M.D., Ph.D. habil.

4. Title: Lipid abnormalities in hypothyreoidism.
5. Title: The function of LDL in lipid metabolism
Tutor: György Paragh M.D., Ph.D., D.Sc.

6. Title: Diagnostic tests and imaging techniques in endocrinology.
Tutor: Endre Nagy M.D., Ph.D., D.Sc.

7. Title: Adipokines and Insulin Resistance
8. Title: Insulin resistance and non-alcoholic fatty liver disease
9. Title: Obesity: Diagnosis and Treatment
10. Title: Obesity: Etiology and Co-morbidities
Tutor: Péter Fülöp M.D., Ph.D. habil.

11. Title: Diabetic neuropathy and oxidative stress
Tutor: Ferenc Sztanek M.D., Ph.D.

12. Title: Autoimmune disorders and GI tract
Tutor: Zsolt Barta M.D., Ph.D.

13. Title: The disease course after stent inplantation in peripheral arterial disease
Tutor: György Kerekes M.D., Ph.D.

14. Title: Novel therapeutical approaches in multiple myeloma
15. Title: The impact of multi-drug resistance genes in the prognosis of lymphoproliferative disorders
Tutor: László Váróczy M.D., Ph.D. habil.

16. Title: Inherited and acquired thrombophilia
17. Title: New direct oral anticoagulants
18. Title: Stem cell therapy in peripheral arterial disorders
Tutor: Zoltán Boda M.D.,Ph.D.,D.Sc.

19. Title: Gastric cancer: clinics and treatment
20. Title: Gastrointestinal bleeding
21. Title: Gluten sensitive enteropathy
22. Title: Inflammatory bowel diseases.
23. Title: Lymphomas in the gastrointestinal tract.
Tutor: István Altorjay M.D., Ph.D., D.Sc.

24. Title: Langerhans histiocytosis
25. Title: Osteosclerotic myeloma
26. Title: Therapeutic challenges in rare haemostatic disorders
Tutor: György Pfliegler M.D., Ph.D. habil.

27. Title: Epidemiology, diagnostics and therapy of chronic hepatitis C
28. Title: Pathomechanism of alcoholic hepatitis
29. Title: Signs, diagnostics and treatment of portal hypertension.
30. Title: Therapeutic options in primary sclerotizing cholangitis
31. Title: Treatment of autoimmune hepatitis
Tutor: István Tornai M.D., Ph.D. habil.

32. Title: A case history of an interesting acute myeloid leukaemia patient in the 2nd Department of Medicine (connection with the literature data)
Tutor: Attila Kiss M.Sc., Ph.D. habil.

33. Title: Chronic neutrophilic leukaemia
Tutor: Béla Telek M.D., Ph.D.

34. Title: Biological treatment of ulcerative colitis
35. Title: Extraintestinal association in IBD
Tutor: Károly Palatka M.D., Ph.D. habil.

36. Title: The role of Willebrand factor in various internal diseases.
Tutor: Ágota Schlammadinger M.D., Ph.D.

37. Title: Bacterial infection in liver cirrhosis
38. Title: Clinical significance of chronic pancreatitis
39. Title: Current therapeutic options of acute pancreatitis
Tutor: Zsuzsa Vitális M.D., Ph.D.

40. Title: Diagnosis and treatment of chronic lymphocytic leukemia
41. Title: Novel therapeutic approches in the treatment of multiple myeloma
42. Title: Philadelphia negative chronic myeloproliferative neoplasms - novel genetic and therapeutic improvements
43. Title: Recent advances in the management of chronic ITP
Tutor: Péter Batár M.D., Ph.D.

44. Title: Are the bacterial infections predictable in liver cirrhosis?
45. Title: Role of serological markers in prediction of disease course and response to therapy in inflammatory bowel diseases.
Tutor: Mária Papp M.D., Ph.D. habil.

46. Title: Gastoesophageal reflux disease
Tutor: László Dávida M.D.

Department of Pharmacology and Pharmacotherapy

1. Title: Cardiovascular risk factors
2. Title: Metabolic link between obesity and insulin resistance
Tutor: Zoltán Szilvássy M.D., Ph.D., D.Sc.

3. Title: Anxiety in the dental chair: pharmacological treatment
4. Title: Arrhythmic patient in dentistry
5. Title: Optional title in pharmacology
6. Title: Parkinson patient in the dental chair
7. Title: Pharmacological and clinical significance of adenosine receptor antagonists
8. Title: Pharmacological and non-pharmacological treatment of endothelial dysfunction
9. Title: Pharmacology of antidepressive drugs: dental implications
10. Title: Pharmacotherapy of trigeminal neuralgia
Tutor: József Szentmiklósi M.D., Ph.D.

11. Title: Emerging roles of prostaglandin DP1 and DP2 receptors in acute and chronic aspects of allergic diseases
12. Title: Optional title in pharmacology
13. Title: Pharmacological treatment of acute decompensated heart failure (ADHF)
14. Title: Pharmacology of herbal remedies
15. Title: Pharmacology of neurogenic inflammation
16. Title: Pharmacotherapy of Amyotrophic Lateral Sclerosis (ALS)
17. Title: Pharmacotherapy of Duchenne Muscular Dystrophy (DMD)
18. Title: Possible pharmacological exploitations of TRPV1 receptors
19. Title: Use of Histone deacetylase inhibitors (HDI): Novel advances in cancer treatment
Tutor: Róbert Pórszász M.D., Dr. habil., MBA, Ph.D.

20. Title: Effect of colony stimulating factors or other drugs on bone marrow-derived cell lines
21. Title: How insulin resistance influences drug effects
22. Title: Selected topic in field experimental hemato-oncology
Tutor: Ilona Benkő M.D., Ph.D.

23. Title: Connections between rheumatoid arthritis and periodontal disease with a focus on pharmacotherapy
24. Title: Immune checkpoint inhibitors in advanced oral cancer
25. Title: Optional title on cancer chemotherapy
Tutor: Attila Megyeri M.D., Ph.D.

26. Title: Class I antiarrhythmic agents: dental implications
27. Title: COX-3 inhibitors in the dental practice
28. Title: Optional title in pharmacology
29. Title: Pharmacotherapy of bronchial asthma: dental implications
30. Title: Reflux disease and the dental patient
Tutor: Ágnes Cseppentő M.D.

31. Title: Optional title on antibacterial chemotherapy
Tutor: Zsuzsanna Gál M.Sc., Ph.D.

32. Title: Optional title in pharmacology
Tutor: Béla Juhász D.Pharm., Dr. habil., Ph.D.

33. Title: Optional title in pharmacology
Tutor: Balázs Varga D.Pharm., Ph.D.

34. Title: Optional title in pharmacology
Tutor: Mariann Bombicz D.Pharm.

35. Title: Optional title in pharmacology
Tutor: Dániel Priksz D.Pharm.

Department of Physiology

1. Title: Expression and significance of the TASK channels in physiological and pathological conditions
Tutor: Péter Szücs M.D., Ph.D.
2. Title: Alterations of intracellular calcium concentration in pathological conditions
Tutor: László Csernoch M.Sc., Ph.D., D.Sc.

3. Title: Regional differences in the electrophysiological properties of cardiomyocytes
Tutor: Péter Nánási M.D., Ph.D., D.Sc.

4. Title: Role of afterdepolarization mechanisms in the arrhythmogenesis
Tutor: Tamás Bányász M.D., Ph.D.

5. Title: Electrophysiological properties of mammalian cardiac tissues
Tutor: János Magyar M.D., Ph.D.,D.Sc.

6. Title: Beat-to beat variability of cardiac repolarization
Tutor: Norbert Szentandrássy M.D., Ph.D.

7. Title: Studies on ion channels incorporated into artificial membranes
Tutor: István Jóna M.Sc., Ph.D., D.Sc.

8. Title: Role of late sodium current in the arrhythmogenesis
Tutor: Balázs Horváth M.D.,Ph.D.

9. Title: Role of potassium channels in neuron function
Tutor: Balázs Pál M.D., Ph.D.

10. Title: Properties of vanilloid receptors
Tutor: István Balázs Tóth M.Sc., Ph.D.

11. Title: Role of Protein Kinase C isoforms in cell function.
Tutor: Gabriella Czifra M.Sc., Ph.D.

CHAPTER 13
LIST OF TEXTBOOKS

1st year

Methods of Molecular Biology:

J. Sambrook, E. F. Fritsch, T. Maniatis: Molecular Cloning, A laboratory manual.
3rd edition. Cold Spring Harbor Laboratory Press, 2001.
Department of Medical Chemistry: Department of Medical Chemistry.
URL: http://www.medchem.dote.hu
R. A. Meyers (ed.): Molecular Biology and Biotechnology.
A comprehensive desk reference, 1995.

Molecular Immunology:

Peter Parham: The Immune System.
3rd Edition. Garland Science, 2009. ISBN: ISBN: 0-8153-4146-6.

Biophysics:

Damjanovich, S., Fidy, J., Szöllősi, J.: Medical Biophysics.
1st edition. Medicina, 2009. ISBN: 978 963 226 249 9.

Molecular Genetics:

Hartl D. L.: Essential Genetics: A Genomics Perspective.
6th edition. Jones & Bartlett Publishers, 2014. ISBN: 978-1-4496-8688-8.
Practical Courses in Genetics.
University Medical School of Debrecen, 2002.
Robert L. Nussbaum, Roderick R. McInnes, Huntington F. Willard, Ada Hamosh: Thompson and Thompson Genetics in Medicine.
8th edition. Saunders Elsevier, 2016. ISBN: 978-1-4377-0696-3.
Tom Strachan, Andrew P. Read: Human Molecular Genetics.
4th. Garland Science, 2011. ISBN: 0-8153-4184-9.
Thomas D. Gelehrter, Francis S. Collins, David Ginsburg: Principles of Medical Genetics.
2nd. Williams and Wilkins, 1998. ISBN: 0-683-03445-6.

Medical Genome Biology:

Campbell, A. M., Heyer, L. J.: Discovering genomics, proteomics and bioinformatics.
Pearson Education Inc.. ISBN: 0-8053-4722-4.

Radioisotope Techniques In Biomedicine Practical:

J. Magill, J. Galy: Radioactivity Radionuclides Radiation.
Springer, 2005.

Radioisotope Techniques in Biomedicine:

J. Magill, J. Galy: Radioactivity Radionuclides Radiation.
Springer, 2005.

Biochemistry of Metabolism:

Thomas M. Devlin: Textbook of Biochemistry with Clinical Correlations.
6th edition. Wiley-Liss, 2006.

Human Physiology I.:

A. Fonyó: Principles of Medical Physiology.
Medicina Publishing House, Hungary, 2002.
ISBN: 963-242-726-2.
Physiology Practice. A Laboratory Guide.
revised edition.2000.
Physiology Practice. Exercise Book.
revised edition.2000.

Physiology of Prokaryotes and Molecular Virology:

Dimmock, N., Easton, A., Leppard, K.: Introduction to Modern Virology.
6th edition. Wiley-Blackwell, 2007.
White D.: The Physiology and Biochemistry of Prokaryotes.
3rd edition. Oxford University Press, 2006.
Alan J. Cann: Principles of Molecular Virology.
5th edition. Elsevier Ltd., 2012.
Carter, J., Saunders, V: Virology: Principles and Applications.
Wiley, 2007.

Cell Biology:
Alberts et al.: Essential Cell Biology.
3rd edition. Garland Public Inc., 2004. ISBN: 0-8153-3481-8.
Lodish et al.: Molecular Cell Biology.
4th edition..
Alberts et al.: Molecular Biology of the Cell.
5th edition. Garland Public Inc., 2007.

Biostatistics:
Wayne W. Daniel: Biostatistics. A foundation for Analysis in the Health Sciences.
John Wiley & Sons. ISBN: 0-471-16386-4.

Plant Molecular Biology:
Taiz, L., Zeiger, E.: Plant Physiology.
Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, 2003.
: Selected thematic reviews from Progress in Botany.
Annual Review of Plant Biology.
Tansley reviews of New Phytologist.

Human Physiology II.:
A. Fonyó: Principles of Medical Physiology.
Medicina Publishing House, Hungary, 2002.
ISBN: 963-242-726-2.
Physiology Practice. A Laboratory Guide.
revised edition.2000.
Physiology Practice. Exercise Book.
revised edition.2000.

Human Physiology Practicals:
A. Fonyó: Principles of Medical Physiology.
Medicina Publishing House, Hungary, 2002.
ISBN: 963-242-726-2.
Physiology Practice. Exercise Book.
revised edition.2000.
Physiology Practice. A Laboratory Guide.
revised edition.2000.

Methods in Molecular Biology Practicals:
J. Sambrook, E. F. Fritsch, T. Maniatis: Molecular Cloning, A laboratory manual.
3rd edition. Cold Spring Harbor Laboratory Press, 2001.
Department of Medical Chemistry: Department of Medical Chemistry.
URL: http://www.medchem.dote.hu
R. A. Meyers (ed.): Molecular Biology and Biotechnology.
A comprehensive desk reference, 1995.

Cell Biology Practice:
Cell Biology Laboratory Manual.
Department of Biophysics and Cell Biology, 2003.
Lodish et al.: Molecular Cell Biology.
4th edition..
Alberts et al.: Molecular Biology of the Cell.
5th edition. Garland Public Inc., 2007.

2nd year

Bioinorganic Chemistry:
Gergely, P.: Introduction to Bioinorganic Chemistry for Medical Students.
Medical and Health Science Center, University of Debrecen, 2008.

Impaired Signal Transduction in the Immune System:
Abbas, A. K., Lichtman, A. H., Pillai, S.: Basic Immunology.
4th Edition. Saunders, 2012. ISBN: 1-4557-0707-4.

Signalling Pathways in the Cells :
Alberts et al.: Essential Cell Biology.
3rd edition. Garland Public Inc., 2004. ISBN: 0-8153-3481-8.
: Cell Signalling Biology.
URL: http://www.biochemj.org/csb/

Enzymology:
N.C. Price, L. Stevens: Fundamentals of Enzymology.
3rd edition.1999.
J.A. Goodrich, J.F. Kugel: Binding and Kinetics for Molecular Biologists.
Cold Spring Harbor Laboratory Press, 2007.
T. Keleti: Basic Enzyme Kinetics.
Akadémiai Kiadó, 1990.
P. Friedrich: Supramolecular Enzyme Organization: Quaternary Structure and Beyond.
Pergamon Press, 1984.

Department of Medical Chemistry: Department of Medical Chemistry.
URL: http://www.medchem.dote.hu
Cohen, P.: Outline Studies in Biology, Control of Enzyme Activity.
2nd edition.1983.
J. Sambrook, E. F. Fritsch, T. Maniatis: Molecular Cloning, A laboratory manual.
3rd edition. Cold Spring Harbor Laboratory Press, 2001.

Post-translational Modification of Proteins:

Christopher T. Walsh: Posttranslational Modification of Proteins. Expanding Nature's Inventory.
Roberts and Company Publishers, 2006. ISBN: ISBN 0-9747077-3-2.
J. Aradi, P. Bagossi, Z. Balajthy, M. Balázs, C. Csortos, V. Dombrádi, I. Farkas, L. Fésüs, P. Gergely, L. Nagy, M. Punyiczki, B. Scholtz, J. Tőzsér, L. Virág: Biochemistry and Molecular Biology. I.
2016.
Fésüs László: Molecular Biolog .
Fourth Edition.2004.

Basis of Conventional and Biological Immunotherapies:

Abbas, A. K., Lichtman, A. H., Pillai, S.: Basic Immunology.
4th Edition. Saunders, 2012. ISBN: 1-4557-0707-4.
Peter Parham: The Immune System.
3rd Edition. Garland Science, 2009. ISBN: ISBN: 0-8153-4146-6.
Fred S. Rosen: Case Studies in immunology.
3rd edition.2001.

Immunological Methods in Molecular Biology:

Abul K. Abbas: Cellular and Molecular Immunology.
8th Edition. Elsevier, 2014. ISBN: 9780323222754.
Kenneth Murphy: Janeway's Immunobiology.
8th Edition. Garland Science, 2011. ISBN: 9780815342434.

New System Biology Paradigms in Immunology:

Peter Parham: The Immune System.
3rd Edition. Garland Science, 2009. ISBN: ISBN: 0-8153-4146-6.