UNIVERSITY OF CRETE

STUDY GUIDE

MSc PROGRAMME

“IMMUNOBIOLOGY”

DEPARTMENT OF BIOLOGY

2024

DEPARTMENT OF BIOLOGY

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Overview of the Department of Biology

The Department of Biology was initiated in 1981, when the Governing Council of the University invited Profs. F.C. Kafatos and V. Nafpaktitis to join the faculty, on joint appointments (with Harvard University and University of Southern California, respectively). The first two professors organized the new Department along modern lines, into two Sections reflecting broad levels of biological organization rather than traditional disciplines (Zoology, Botany, Microbiology, etc): Section A included Biochemistry, Molecular Biology, Cellular and Developmental Biology, and Section B included Biology of Organisms, Populations, Environment and Marine Biology. Another initiative, novel for Greece, was to add a section devoted to applications of the Life Sciences: Section C included Biotechnology and Applied Biology. This original plan envisaged a collegial faculty structure, representing a radical departure from the then prevalent Chair system. Its implementation became effective the following year, with the adoption of a new law by the Greek Parliament, reforming higher education along similar lines.

In terms of subject matter, the original plan envisaged emphasis on selected areas of Biology in which a critical mass of internationally competitive faculty could be attracted, and which offered the possibility for the new Department to play a pioneering role in the Greek University system. Among these focal areas were Molecular Genetics, Cell and Developmental Biology, Marine Biology, Applied Biology and Biotechnology. This emphasis was reinforced by the creation of two Research Institutes, independent of but in close collaboration with the Department of Biology. These institutes (IMBB and IMBC) offered important research opportunities for faculty members in the respective areas of interest, and made possible the foundation of an organized Graduate Programme. As the Department grew, it expanded its coverage in the areas of Biochemistry, Physiology, Ecology, Evolutionary Biology and Microbiology, thus permitting the development of breadth as well as depth in the curriculum and the research programme.

Since 1982 a significant number of new faculty members was added to the Department through selection by an international committee of distinguished Greek biologists from the European Union and the United States. Once the Department was large enough, it became independent in electing its faculty and setting its own educational policies.

Reflecting its emphasis on scholarship, the Department began its educational activities in 1983 at the graduate programme level. The Graduate Programme, was modelled after similar programmes in the U.S. and included a full course curriculum, laboratory rotations and qualifying examinations. The first undergraduates were admitted in 1987. Today the Department of Biology has 24 Faculty members, 11 laboratory assistants and an English instructor.

Departmental Administration

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I. REGULATIONS AND CURRICULUM

1. Aims of the Programme

The Department of Biology of the University of Crete offers an MSc programme with title **"Immunobiology"** with the participation of tutors from other departments of the University of Crete (Medical School, Department of Chemistry, Department of Materials Science and Engineering), the Foundation for Research and Technology and external collaborators from other Greek Universities.

The aim of this MSc program is to provide graduates with an advanced understanding of the immune system and its functions. This field of study delves into the biological and biochemical mechanisms that the immune system uses to protect the body from pathogens, its role in diseases, disorders, and therapeutic or defensive interventions, expanding from mammals to plants. The key objectives of the MSc programme are:

- **Foundational Knowledge**: To deepen understanding of the fundamental principles of immunology, including the cellular and molecular processes that underpin innate and adaptive immunity.
- **Research Skills**: To develop practical and analytical skills necessary for conducting scientific research. This includes learning techniques for studying immune responses, handling biological data, and using advanced laboratory equipment.
- **Critical Thinking**: To enhance abilities to critically evaluate current research and literature in immunobiology, facilitating an understanding of the cutting-edge issues and technological advancements in the field.
- **Disease Understanding**: To study the immune system's roles in health and disease, understanding how various immune responses can contribute to the pathogenesis of different diseases, including autoimmune diseases, allergies, and cancer.
- **Therapeutic Applications**: To explore the development of immunological approaches to disease prevention and treatment, such as vaccines and immunotherapies.
- **Professional Skills**: To prepare students for professional roles in academic research, the biotechnology and pharmaceutical industries, clinical contexts, and beyond, including positions that require expertise in immunobiology.
- **Ethical and Social Implications**: To discuss the ethical, legal, and social implications of research in immunobiology, particularly in relation to new and emerging technologies such as genetic engineering and personalized medicine.

Overall, graduates of the MSc programme in Immunobiology are expected to emerge as highly knowledgeable and skilled individuals ready to contribute significantly to the field of immunology and related areas.

The graduates can be hired in posts relevant to their expertise, either in the public (hospitals, secondary education, municipalities, etc.) or the private (diagnostic laboratories, pharmaceutical companies, etc.) sector, or can continue to pursue an academic-research career in Universities or Research Organizations.

The field of Immunology is currently experiencing significant growth and is increasingly attractive in both the public and private sectors. This interest is driven by several key factors such as Advances in Medical Research and Technology: Rapid advancements in biomedical research and technologies, especially in areas like genomics, proteomics, and bioinformatics, have greatly expanded our understanding of the immune system. This has led to new opportunities in research and development. Rise of Immunotherapies: There has been a surge in the development and approval of immunotherapies for a range of diseases, particularly cancers and autoimmune diseases. This has generated a strong demand for professionals skilled in immunobiology. Global Health Challenges: The ongoing challenges posed by infectious diseases, as evidenced by the COVID-19 pandemic, and the global efforts to manage them through vaccination and other immune-based strategies highlight the critical role of immunology. Aging Populations: Aging populations worldwide are more susceptible to diseases, many of which are related to immune system

dysfunction. This demographic shift is prompting increased research into how the immune system changes with age and how these changes can be managed or reversed. Biotechnology and Pharmaceutical Industries: These sectors are heavily investing in the development of new drugs and therapies that modulate the immune system, creating a robust job market for immunologists. Public Health and Policy: There is also growing recognition of the role of immunology in public health and policy-making, especially in devising strategies for disease prevention and management, leading to opportunities in governmental and international health organizations. Advances in Veterinary Immunology: Improving animal health has widespread effects on human working sectors, like food and agriculture. There is rising need in animal disease prevention and therapy, especially for infections naturally transmitted across the species barrier. Challenges in Plant Biotechnology: There are increasing efforts in the use of immune molecules in disease-resistant and production improvement plant biotechnology. Academic and Research Institutions: There is a steady demand for immunobiology experts in academic settings, not only to lead research projects but also to educate the next generation of scientists and healthcare professionals. *Overall, these factors contribute to a vibrant and expanding field, making immunobiology an attractive career choice for those interested in cutting-edge science and its applications in health and disease management.*

2. Academic Staff

The academic staff of the programme comprises of Faculty, Laboratory Instructors, Special Technical Personnel and Scientific Collaborators of the faculty of the Department of Biology. Academic staff from other Departments of the School of Science and Technology of the University of Crete, the Foundation for Research and Technology and other well-known academic institutions in Greece will participate as tutors in the programme. The programme's academic staff combines a wide range of backgrounds and specialties (molecular/cellular immunology, molecular biology, cellular biology, biochemistry, developmental biology, microbiology, cancer biology, chemistry and mathematics) that provide the necessary interdisciplinary mix for the implementation of the educational goals of the curriculum.

The academic staff of the programme is listed below:

Faculty		
#	**Staff Member**	**Area of Expertise**
Department of Biology, UoC		
1	Irene Athanassakis (Professor)	Immunobiology
2	Charalampos Spilianakis (Professor)	Molecular Immunology, autoimmunity
3	George Garinis (Professor)	Genetics, functional genomics, DDR and the cause of inflammatory diseases
4	Daphne Bazopoulou (Assis. Professor)	Oxidative stress; Redox signaling during aging and host-microbe interactions, entrepreneurship
5	Electra Gizeli (Professor)	Molecular diagnostics
6	George Zachos (Associate Professor)	Cell biology, cancer biology and cell cycle
7	Ioanna Keklikoglou (Assis. Professor)	Cancer Immunology/immunotherapy
8	Dimitrios Papadopoulos (Assoc. Professor)	Molecular Biophysics
9	Panagiotis Sarris (Assoc. Professor)	Microbiology, host/microbe molecular interactions, plant molecular immunology
10	Kyriaki Sidiropoulou (Assoc. Professor)	Neurobiology, neuroimmunology
11	Stergios Pirintsos (Professor)	Natural products, intellectual property, entrepreneurship
12	Christos Delidakis (Professor)	Drosophila genetics, model organisms, immune response

13	Michael Pavlidis (Professor)	Fish biology, endocrinology
14	Panagiotis Moschou	Plant physiology/immunology
15	Joseph Papamatheakis (Professor emeritus)	Molecular biology, MHC Class II gene regulation, cancer biology
16	Anastassia Papadaki	Lab Teaching Staff
17	Despoina Dokianaki	Lab Teaching Staff
18	Elena Kouimtzoglou	Lab Teaching Staff
19	Maria Dramoundani	Technical Assistants and Laboratory Staff
20	Sevasti Papadogiorgaki	Lab Teaching Staff
21	George Tserevelakis	Lab Teaching Staff
Medical School, UoC		
1	Panagiotis Verginis (Assoc. Professor)	Mechanisms of immune regulation, autoimmune diseases and cancer
2	George Bertsias (Assoc. Professor)	Rheumatology - Clinical Immunology
3	Alexandros Zafiropoulos (Assoc. Professor)	Clinical Virology - Histology
Department of Chemistry, UoC		
1	Nikolaos Eleftheriadis (Assis. Professor)	Protein dynamics, drug design, anti-inflammatory drugs, antibiotics
Department of Materials Science and Technology, UoC		
1	Kelly Velonia (Assis. Professor)	Materials Chemistry, Synthetic Biomaterials and Applications, Biopolymers, Polymers, Catalysis, Supramolecular Chemistry
Greek Research Institutions		
1	Anthi Ranella (Principal Researcher – FORTH)	Tissue Engineering –Regenerative Medicine and Immuno-engineering
2	Giorgos Gouridis (Research Assoc. Professor – FORTH)	Protein folding, binding and dynamics
3	Michail Kotsyfakis (Principal Researcher – FORTH)	Disease vector biology
Other Academic Institutions		
1	Eleftheria Rosmaraki (Assis. Professor – Dept. Biology - Univ. Patras)	Natural Killer cell development and function
2	Minas Yangkou (Biology-AUTH)	Molecular Biology, Immunology
3	Eric Pinaud (Director of Research, Univ. Limoge, France)	Control of B cell response and lymphoproliferation
4	Pantelis Katharios (Researcher - Hellenic Centre for Marine Research (HCMR)	Microbiology

Laboratory Instructors	
Anastassia Papadaki	

Despoina Dokianaki	
Elena Kouimtzoglou	
Sevasti Papadogiorgaki	
George Tserevelakis	

Special Technical Personnel	
Maria Dramoundani	

3. Curriculum Structure and Learning Outcomes

The curriculum of the programme comprises core courses, which are compulsory.

The following table (Table I) summarizes the courses and their individual characteristics, namely the semester of study of each course, its weight in ECTS units. Upon approval of the department's meeting and before the new academic year begins, new courses may be added whenever possible.

IMM: IMMunobiology, **XXX:** Year/Semester/Course Number

Courses

Year/Semester	Code	Title	ECTS
1/1	IMM111	Immunity & Immune System	7
1/1	IMM112	Microbial Pathogenesis & Infection	7
1/1	IMM113	(Patho)Physiology of the Immune System	5
1/1	IMM114	Therapeutic Immunology	3
1/1	IMM115	Research approaches for the study of the immune system	8
1/2	IMM121	Experimental Immunology - Laboratory Training in Immunological Techniques	10
1/2	IMM122	Transferable Research Skills	5
1/2	IMM123	Cooperative Training – Group Discussions – Journal Club	5
1/2	IMM124	Research proposal – Designing a Research Project	5
1/2	IMM125	Laboratory training – Rotation 1	5
1-2/1	IMM211	Laboratory training – Rotation 2	5
2/1-2	IMM212	MSc Research Project & Thesis	55
		TOTAL	**120**

Upon the successful examination in the courses the students will receive their degree with 120 ECTS. A student can attend more courses (with the agreement of the course tutor) if they wish, and provided they have collected the required ECTS. The extra courses will be listed in the diploma supplement.

The weight of each course is stated in European Credit Transfer System (ECTS) units. The six-month workload of a student is the sum of the ECTS units of the courses in which this semester is enrolled. The MSc programme is summarized as follows:

- The first year includes acquiring theoretical knowledge in all aspects of of Immunobiology as well as all the new trends and technologies including therapeutic perspectives. More importantly the training of the students in the first year includes laboratory training and hands on experience in a great variety of research approaches necessary for an immunologist either in an academic setting or the private sector.
- Each student will have the opportunity to get laboratory training in two individual laboratories that participate in the programme, involved in the design and implementation of a project.
- A compulsory Research thesis in a topic related to Immunobiology, which is implemented during the 2nd year after the approval by the Programme Managing Committee.
- Compulsory attendance of the departmental seminars in the field of Immunobiology, which will be accompanied by discussion with the supervisor.

All the courses will be taught in physical presence at the University of Crete, but there is an option of online teaching, at a percentage of 50% of the total teaching hours per course, if this is necessary, and after sufficient justification and approval by the Programme Managing Committee (PMC). For the online teaching, the electronic infrastructure of the University of Crete will be used and in specific the e-class platform (https://eclass.edc.uoc.gr/), as well as other tools for remote education such as Microsoft Teams, Webex, ZOOM e.t.c.

The courses will be taught at the predetermined dates and times following the programme timetable. The students are obliged to attend all the courses and the activities of each course and to comply with the decisions of the PMC and the academic ethics. The absence in more than 3 lectures leads automatically in the failure of the specific course and the student is obliged to attend the course again the next semester it is offered. Failure in a course is only accepted once, while in case of a second time failure the student is expected to leave the programme. In the case that a student, due to exams failure in certain courses, needs to enroll for an additional semester, the respective fees for this semester should be paid.
The PMC designates an **Academic Advisor** for each student who monitors the progress and advices the student during the programme.
The anticipated Learning Outcomes of the graduate programme for the MSc Degree in "Immunobiology" are the following: to acquire the interdisciplinary knowledge and scientific background of Immunobiology and its applications and the current technological advancements, to promote students' free, creative and critical thinking, develop their ability to analyze, evaluate and solve contemporary problems related to Immunobiology, develop a spirit of collaboration and teamwork, and specialize in modern research methods in cutting-edge and interdisciplinary optional scientific fields.
The Learning Outcomes of the Curriculum correspond to the 7th level of the EU classification for educational qualifications.

4. Obtaining a degree

The exam for each course is taken at the end of the respective course. The assessment of the student takes also into account their participation in the course lectures during the semester, their performance in the homework and projects assigned by the tutors. The assessment for each course is defined by the tutors. The tutors are obliged to provide the evaluations of the course at a maximum of three (3) weeks after the final exam. In case there are more than one tutors in a course the mode of assessment is decided collectively by the tutors and announced to the students at the beginning of the course.
The evaluation for each course ranges between 0 and 10 with decimals of 0.5. The successful participation in a course is considered when the students has acquired an evaluation of 6.0/10.0. The MSc degree is awarded to a student when the average grade of all courses (including the Research Thesis) is at least seven (7.0/10.0), which is the final grade of the Master's Degree.

5. Diploma thesis

The Research Thesis corresponds to 55 ECTSs and is implemented during the third and fourth semester of the programme. It is research intensive and is supervised by a two-member committee. The committee includes the supervisor of the research thesis and comprises faculty members and researchers from the University of Crete or the collaborating organization. Professors or researchers from other academic or research institutions in Greece or abroad, that possess a PhD, can also act as co-supervisors of the student's MSc thesis. The members of the committee should have the same or similar specialty to that of the research thesis.
The students can apply for the research thesis after they have collected at least 60 ECTS. During the second semester, the interested tutors and other members of the programme present shortly the offered research topics. The students have the opportunity to discuss with the tutors and possibly

start studying the topic before they undertake the thesis officially.
The implementation process of the research thesis after the approval of the PMC is as follows:

a) Following the agreement of the supervisor the PMC approves the topic and the two-member committee for the research thesis,
b) After the completion of the thesis, the date of the presentation/defense is announced following the agreement of the two-member committee,
c) The thesis is handed in electronic form to the two committee members. The thesis should be handed to the committee at least ten (10) days before the defense. The defense takes place only after the agreement of all committee members.

The committee members assess the thesis in terms of its originality and innovative nature, the literature review, scientific methodology, the research perspectives and the implementation of the experiments and analysis of the results, as well as the presentation of the work by the student. The procedure is completed with the assessment of the thesis presentation and the respond of the student to the questions provided by the examiners. The research thesis is evaluated as "satisfactory" or "unsatisfactory".
If a research thesis is assessed as "unsatisfactory", the student must undertake the necessary corrections/improvements following the recommendations of the examination committee. Then a second defense follows at a date that is defined by the members of the committee and within six (6) months after the date of the first defense. If the thesis is assessed again as "unsatisfactory", no third chance is given to the student. In this case the student is not awarded the MSc degree, but rather receives a certificate stating that they have successfully completed the graduate courses.

6. Student internships

After the completion of the theoretical training, the students have the opportunity to get laboratory training in two individual laboratories that participate in the programme. Via these internships the students aim to gain experience, expand their knowledge and specialize in subjects related to immunobiology and the new trends in therapeutic interventions. The internships also give the students the opportunity to adapt and function within a professional environment and to develop the skills related to teamwork. To enroll in the internship program, the students need to apply. Their record and specific requirements of different positions will be considered by the PMC which shall decide taking under consideration the first three preferences of the student for getting training in specific laboratories. Within one month upon completion of the internship, the student shall submit a written 'activity report' which will be utilized for the evaluation of the student and will be kept in the student's records. The student's overall performance shall be assessed by the PMC.
Students also have the option to participate in internship programs abroad, in Universities or Research Centers and Institutions in the context of ERASMUS+ program. The same rules apply (activity report and seminar, ECTS 5).

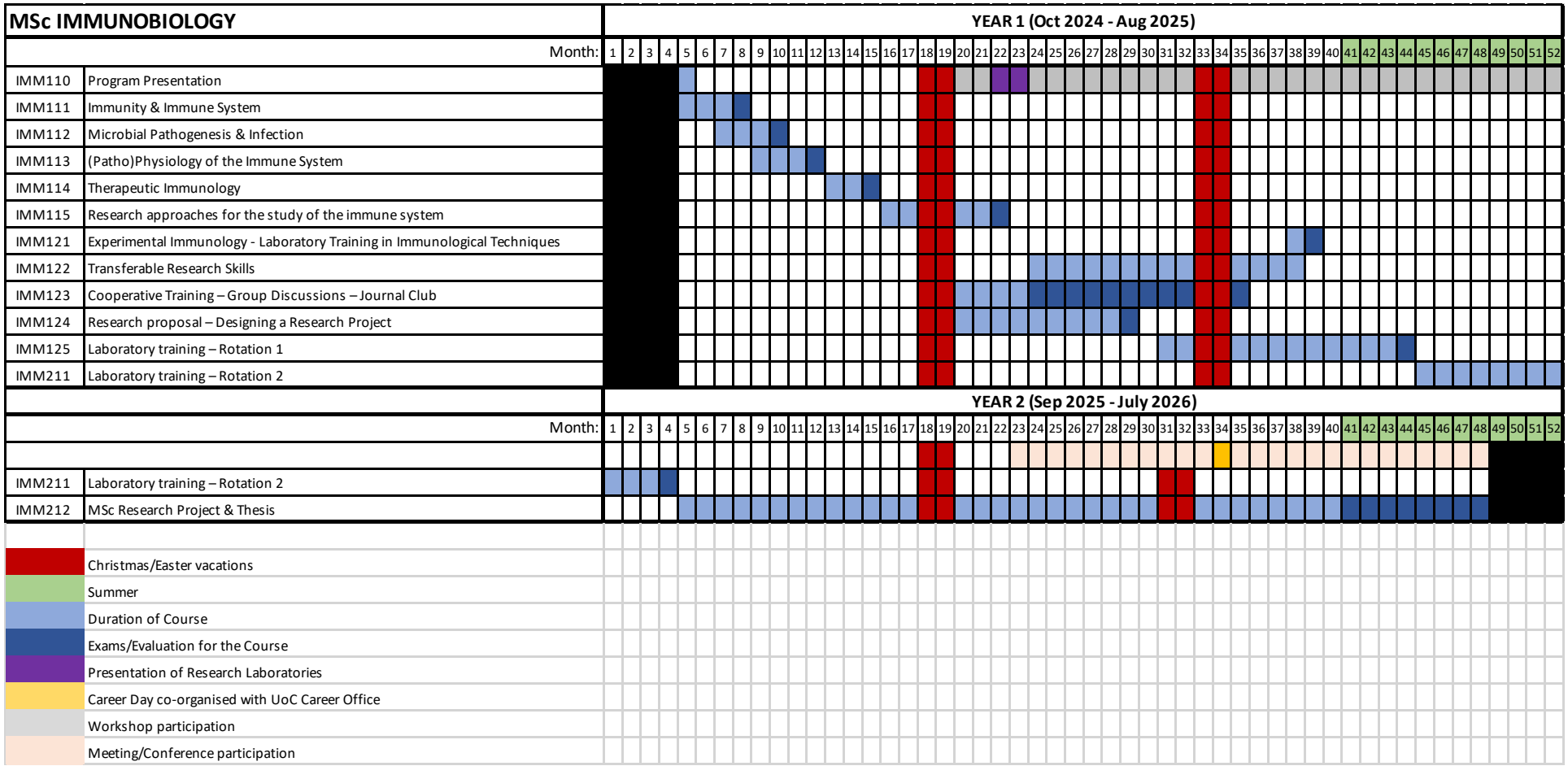
7. Programme language

All courses of the programme, including the writing of the diploma thesis, are taught in English, which is the official language of the programme.

II. DETAILED DESCRIPTION OF COURSES

IMM: IMMunobiology, **XXX:** Year/Semester/Course Number

Courses			
Year/Semester	**Code**	**Title**	**ECTS**
1/1	IMM111	Immunity & Immune System	7
1/1	IMM112	Microbial Pathogenesis & Infection	7
1/1	IMM113	(Patho)Physiology of the Immune System	5
1/1	IMM114	Therapeutic Immunology	3
1/1	IMM115	Research approaches for the study of the immune system	8
1/2	IMM121	Experimental Immunology - Laboratory Training in Immunological Techniques	10
1/2	IMM122	Transferable Research Skills	5
1/2	IMM123	Cooperative Training – Group Discussions – Journal Club	5
1/2	IMM124	Research proposal – Designing a Research Project	5
1/2	IMM125	Laboratory training – Rotation 1	5
1-2/1	IMM211	Laboratory training – Rotation 2	5
2/1-2	IMM212	MSc Research Project & Thesis	55
		TOTAL	**120**


MSc IMMUNOBIOLOGY
YEAR 1 (Oct 2024 - Aug 2025)
Month: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
IMM110 Program Presentation
IMM111 Immunity & Immune System
IMM112 Microbial Pathogenesis & Infection
IMM113 (Patho)Physiology of the Immune System
IMM114 Therapeutic Immunology
IMM115 Research approaches for the study of the immune system
IMM121 Experimental Immunology - Laboratory Training in Immunological Techniques
IMM122 Transferable Research Skills
IMM123 Cooperative Training – Group Discussions – Journal Club
IMM124 Research proposal – Designing a Research Project
IMM125 Laboratory training – Rotation 1
IMM211 Laboratory training – Rotation 2
YEAR 2 (Sep 2025 - July 2026)
Month: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
IMM211 Laboratory training – Rotation 2
IMM212 MSc Research Project & Thesis
Christmas/Easter vacations
Summer
Duration of Course
Exams/Evaluation for the Course
Presentation of Research Laboratories
Career Day co-organised with UoC Career Office
Workshop participation
Meeting/Conference participation

DETAILED DESCRIPTION OF COURSES

IMM111. Immunity & Immune System

Duration: 4 weeks (3 weeks tutoring, 1 week evaluation), ECTS: 7
Prerequisite Courses: Cell Biology, Biochemistry, Molecular Biology
Learning Outcomes: Upon completion of the course, the graduate students are expected to:

- Have acquired the basic knowledge in immune system histology
- Have acquired the basic knowledge on molecular immune players
- Understand functioning of the immune system
- Be able to expand the mammalian immune to birds, fish and reptiles

Syllabus

- Properties and Overview of Immune Responses
- Cells and Tissues of the Immune System
- Innate Immunity
- Adaptive Immunity
    - Lymphocyte Development and Antigen Receptor Gene Rearrangement
    - Antibodies and Antigens (Immunoglobulins: protein and gene structure and function) -
    - Antigen Presentation to T Lymphocytes and the Functions of Major Histocompatibility Complex Molecules
    - Immune Receptors and Signal Transduction
    - Activation of T Lymphocytes
    - Differentiation of myeloid and lymphoid cells
        - Differentiation and Functions of CD4 + Effector T Cells
        - Differentiation and Functions of CD8 + Effector T Cells
    - Cytokines - (non-specific response, function, receptors, synergies, cross-talk, signaling)
- Avian immune system
- Fish immune system

Bibliography

Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. Cellular and Molecular Immunology
ISBN: 9780323757485, ISBN: 9780323757508

IMM112. Microbial Pathogenesis & Infection

Duration: 4 weeks (3 weeks tutoring, 1 week evaluation), ECTS: 7
Prerequisite Courses: Cell Biology, Biochemistry, Molecular Biology
Learning Outcomes: Upon completion of the course, the graduate students are expected to:

- Have acquired the basic knowledge in bacterial and viral biology
- Being able to diagnose bacteria and viruses
- Understand bacterial and viral pathogenesis
- Understand how the immune system fights against bacteria and viruses

Syllabus

- Bacteriology:
    - The bacterial cell
    - Nutrition, growth and energy metabolism
    - Genetics
    - Identification, taxonomy
    - Antibiotics and resistance
    - Pathogenesis and immunity
- Virology:
    - Definitions, classification, morphology
    - Structure and function of viral nucleic acids

- Viral proteins and genetics
- Cell-virus interactions
- Anti-viral therapy
- Pathogenesis and immunity

- Parasites:
  - Definitions, classification, morphology
  - Pathogenesis and immunity

Bibliography

Microbiology and Immunology On-line, Hunt, R.C. editor. http://www.microbiologybook.org

IMM113. (Patho)Physiology of the Immune System

Duration: 4 weeks (3 weeks tutoring, 1 week evaluation), ECTS: 5
Prerequisite Courses: Cell Biology, Biochemistry, Molecular Biology
Learning Outcomes: Upon completion of the course, the graduate students are expected to:

- Familiarize with immune privileged sites
- Understand the tissue specific mechanisms underlining immunity
- Understand the failure of immune surveillance
- Learn how to choose model organisms to study specificities of the immune system
- Acquire in depth knowledge in immune system functioning through the study of thymus and immune memory, which consist the basis of immunity
- Understand how the immune system deals with infectious diseases
- Acquire in depth knowledge in innate immunity and the mechanisms that link innate to adaptive immunity
- Acquire the knowledge on the immunogenicity of blood groups
- Understand aging of the immune system
- Understand in depth the genetic background of autoimmunities
- Understand the different mechanisms that govern autoimmunities

Syllabus

- Mucosal immunity
- Neuro-immunology
- Reproductive Immunology
- Cancer Immunology
- Immunologic Tolerance and Autoimmunity
- Genetics of autoimmunities
- Immune Memory
- Immune senescence
- Gut microbiome – Nutrition
- Viral infections
- Stress
- Therapeutical approaches

IMM114. Therapeutic Immunology

Duration: 2.5 weeks (2 weeks tutoring, 0.5 weeks evaluation), ECTS: 3
Prerequisite Courses: Cell Biology, Biochemistry, Molecular Biology, Chemistry
Learning Outcomes: Upon completion of the course, the graduate students are expected to:

- Familiarize with immune system pathologies
- Learn the current therapeutic procedures
- Learn how to develop new therapies
- Understand the benefits and weaknesses of systems used in drug development

Syllabus

- Drug development
- Design and optimization of pharmaceutical compounds
- Vaccines
    - 1st and 2d generation vaccines
    - DNA vaccines
    - mRNA vaccines
    - edible vaccines
- Immunotherapies
    - Biological therapies (molecular, gene, cell therapies) -
- Polymeric nanocarriers, design and application to drug delivery
- Off-target effects, side-effects of bioactive compounds

IMM115. Research approaches for the study of the immune system

Duration: 5 weeks (4.5 weeks tutoring, 0.5 weeks evaluation), ECTS: 8
Prerequisite Courses: Cell Biology, Biochemistry, Molecular Biology, Genetics
Learning Outcomes: Upon completion of the course, the graduate students are expected to:

- Acquire the knowledge in the biology of model organisms in research
- Understand the different pathways that can be studied in model organisms
- Understand the rationale and state-of-the-art in ex vivo manipulation procedures including material exploitation and microfluidics in cell differentiation and tissue development
- Familiarize with basic principles of molecular biology at the gene and protein level
- Acquire knowledge on gene and protein manipulation
- Familiarize with novel technologies in the study of genes and proteins
- Get all necessary tools for the study of immune molecules
- Acquire the necessary knowledge on the state-of-the-art techniques to be used in answering the scientific questions cellular and molecular immunology.

Syllabus

- Gene structure, expression and function
- Experimental design, bioinformatics in molecular biology
    - Genome editing (zinc-finger nucleases, TALENs, CRISPR/Cas9)
    - Transcription factor families and chromatin-binding kinetics
    - Transcription factor binding site acquisition on enhancers; interactions with RNA Polymerase II
    - Intrinsic and extrinsic transcriptional noise; control of noise (variability) in transcription factor concentration during development, differentiation, and physiology of the organism
    - Formation of biomolecular condensates (phase separation); amino-acid molecular “grammar”; agent and client proteins in condensates; the role of RNA
- Protein interactions: principles and methods
    - Introduction in protein interaction kinetics
    - Principles of protein interaction
    - Protein interaction experimental methodologies
    - Useful protein methodologies
    - Protein interaction maps
- Protein and peptide production in heterologous cellular systems
- Protein expression system in plants
- Introduction to protein analysis using mass spectrometry
- Bio-imaging
    - Confocal microscopy
    - Transmission electron microscopy
    - Single-molecule microscopy methodologies for the study of protein concentration, behavior, and interactions in biological problems [Fluorescence Correlation Spectroscopy

(FCS), Fluorescence Cross-Correlation Spectroscopy (FCCS), Single-molecule tracking, Fluorescence Recovery After Photobleaching (FRAP)], Applications of single-molecule microscopy in the study of development and disease
    - Multiphoton Excitation Fluorescence, Second / Third Harmonic Generation, Optoacoustic Microscopy, Raster Scan Optoacoustic Mesoscopy (RSOM)
    - Live tomographic imaging
- Bioinformatics
- Mathematical models
- Model organisms in the study of immune system
    - Mouse
    - C. elegans
    - Drosophila
    - Plants
    - Organs-on-chip
- **Immunodiagnostics**
    - Diagnostic and therapeutic proteins of the immune system
        - Monoclonal and polyclonal antibodies
        - Cytokines
        - Immunological techniques
            - Immunoprecipitation
            - Immunoaffinity techniques for protein isolation
            - Enzyme-linked immunoassays
            - Immunofluorescence
            - Flow cytometry analysis
    - Proteins at surfaces
        - General principles of biosensors
        - Acoustic and optical biosensors for studying biological interactions
        - Electrochemical sensors -
        - Nanobiotechnology; Devices and integrated systems for diagnostics

IMM121. Experimental Immunology - Laboratory Training in Immunological Techniques

Duration: 2 weeks, ECTS: 10

Practical course

Prerequisite Courses: -

Learning Outcomes: Following this practical course the students are expected to acquire the skills for all basic techniques applied in immune diagnosis, providing at the same time a useful certification for future employment.

Syllabus

- ELISA
- Immunofluorescence
- Flow Cytometry analysis
- Cell culture (cell lines and primary cells)
- Microscopy
- Cytokine quantitative detection
- Immune cell proliferation
- Cellular cytotoxicity
- Phagocytosis
- Immunophenotyping in oncology

IMM122. Transferable Research Skills

Duration: 13 weeks, ECTS: 5

Attendance of BIOL474-Research and Communication skills for Immunologists.

Prerequisite Courses: -
Learning Outcomes: Upon completion of the course, the graduate students are expected to:

- Understand ethical rules in academia and science
- Gain skills in writing and presenting their scientific work
- Learn how to apply for funding
- Understand the various steps towards entrepreneurship
- Learn how to promote their work to an investor
- Learn how to proceed with clinical trials

Syllabus

- **Communication and Research Skills**
  - Academic and research morality
    Scientific ethics
  - Skills of presenting research results
  - Writing a curriculum vitae
  - How to write a thesis
  - How to write a research manuscript
  - Interview skills
  - Writing scholarship applications
- **Entrepreneurship**
  - Basic concepts of entrepreneurship, innovation, intellectual property, utilization of results
    - The Greek ecosystem of new entrepreneurship (4h)
    - Business creation
    - Legal issues
    - Choice of corporate form
  - Funding from an investor
    - From the idea to the business plan
  - Business model canvas
    - Business model design
  - Pitching preparation
  - Mentoring and pitching: develop your own ideas
  - From lab to market – Case study
  - Intellectual property legislation

Bibliography

Study and Communication Skills for the Biosciences 3e, Stuart Johnson and Jon Scott, Oxford University Press 2019

IMM123. Cooperative Training – Group Discussions – Journal Club

Duration: 14 weeks (4 weeks preparation and study of the papers, on week 5 presentations begin), ECTS: 5
Learning Outcomes: Upon completion of the course, the graduate students are expected to develop their critical skills in literature analysis and learn how to collaborate with classmates.
Syllabus
In ten consecutive weeks students with the aid of course coordinator will propose the reading, presentation and discussion of a chosen research article in the field of Immunobiology.
Bibliography
Published research.

IMM124. Research proposal – Designing a Research Project

Duration: 10 weeks, ECTS: 5
10-week project according to specific instructions. A research proposal template along with requirements needed will be provided.

Course Aims: The course aims to provide students with a critical understanding of research approach and methodology as applied to modern biomedical research. Students will have the opportunity to appraise different types of scientific research, and to examine critically the different steps within a research project. Students will demonstrate their understanding and competence through the development of the study design for their own research project, including hypothesis setting, literature review and project work plans. During the course, students will utilise the theoretical knowledge gained to critically review and synthesise the published literature, and to plan their upcoming research projects.

Intended Learning Outcomes of Course: By the end of this course students will be able to:

- critically analyse published literature in a research area, and from this ascertain a scientific question for a research project;
- develop hypotheses and design scientific experiments to address the hypotheses for the research project;
- critically evaluate scientific methods relevant to the research question;
- design a strategy for data analysis that leads to a defined outcome;
- design research in line with accepted research ethics, and legislation involving animal experimentation and research involving humans;
- select and succinctly summarise the key information in a complex research project, and effectively communicate this information to others;
- discuss and defend their research aims and approaches with in-depth awareness of the strengths and caveats of the research project

Timetable: This course consists of lectures, tutorials and supervisor meetings.

Assessment: Oral assessment and presentation - preparation of a scientific poster outlining the student's proposed project plus a 2-minute spoken summary of the poster (60%). Set exercise - viva-style examination of the student's understanding of and plans for their research project (40%).

IMM125. Laboratory training – Rotation 1

Duration: 3 months, ECTS: 5

10-week project in a laboratory of choice.

Course Aims: The course aims to provide students with an opportunity to perform a piece of original research to investigate a hypothesis or research questions within the subject area of the Masters programme. The project work will provide an opportunity for students to develop practical and/or technical skills, analyse data critically and draw conclusions, and suggest avenues for future research to expand their research findings.

IMM211. Laboratory training – Rotation 2

Duration: 3 months, ECTS: 5

10-week project in a laboratory of choice.

Course Aims: The course aims to provide students with an opportunity to perform a piece of original research to investigate a hypothesis or research questions within the subject area of the Masters programme. The project work will provide an opportunity for students to develop practical and/or technical skills, analyse data critically and draw conclusions, and suggest avenues for future research to expand their research findings.

IMM212. MSc Research Project & Thesis

Duration: 10 months, ECTS: 55

Prerequisite Courses: Successful completion of Year 1 studies

Intended Learning Outcomes of Course: By the end of this course students will be able to:

- critically design, plan and execute scientific experiments associated with the subject area of the Master's degree;
- develop and practice troubleshooting skills to address technical scientific and analytical problems;

- critically evaluate and analyse experimental data, and draw conclusions based on their findings;
- evaluate explanatory hypotheses and develop plans for further research, as appropriate to the topic chosen, identifying key areas where future research is needed;
- summarize and critique their own and prior research findings in oral presentations and communicate effectively with peers, supervisors and more senior colleagues;
- present research findings in the form of a critical written report, in correct scientific style using a range of appropriate computer software (e.g. Word, Reference Manager, Excel);
- take responsibility for the research project and associated resources with a degree of autonomy appropriate to the type of research;
- plan and manage time effectively by prioritising tasks and meeting deadlines;
- work co-operatively and effectively with colleagues to develop interpersonal and teamwork skills within a research environment, and reflect critically on their role and performance within the group.

Assessment: The project assessment will consist of the following components:

- Supervisor's report (35%) An assessment of the student's overall performance in the project will be provided by the project supervisor for specified criteria, using a written form with marking descriptors.
- Student's written report (50%) A written report of 10,000- 15,000 words formatted in appropriate scientific style, in the style of a scientific journal appropriate to the project research topic, to be submitted in the penultimate week of the project period. The report will be assessed by the Supervisor and an independent marker and the grade awarded will be an "agreed" mark.
- Oral presentation (15%) A short presentation of the project (followed by questions) to an audience consisting of fellow students and project supervisors in the final week of the course. The presentation will be assessed by two assessors (neither of whom will be the supervisor).