COURSE DETAILS

" INTEGRATED COURSE OF MICROBIOLOGY AND IMMUNOLOGY "

SSD MED/04, MED/07*

DEGREE PROGRAMME: MEDICINE AND SURGERY (P11)

COORDINATOR: PROF. GIUSEPPE MATARESE

ACADEMIC YEAR 2024-2025

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION about the course

TEACHING LANGUAGE: ENGLISH

CHANNEL (IF APPLICABLE): 1

YEAR OF THE DEGREE PROGRAMME: II

SEMESTER: II

CFU: 7

REQUIRED PRELIMINARY COURSES

Molecular and Cellular Biology, Biochemistry

PREREQUISITES

For a proper understanding of the topics discussed in the Integrated Course, students should have acquired general knowledge on Molecular and Cellular Biology, Histology and Biochemistry.

LEARNING GOALS

The main aim of the Microbiology-Immunology Course is to pursue the knowledge of the infectious world and of the way the human organism reacts to it through the immune system.

EXPECTED LEARNING OUTCOMES

Students will acquire the fundamental knowledge that will enable them to understand the underlying mechanisms of the main infectious agents of the microbiological world and how immune system operates to fight infections, in autoimmunity, in transplants and in allergies. The student must, at the end of the course: 1. know the etiopathogenesis underlying the different microorganisms; 2. connect pathophysiological aspects to cellular and molecular changes during infections; 3. Orientate on the physiological and pathological functioning of the immune responses; 4. establish the link between biology of the microorganisms and when they become dangerous for the human being; 5. establish basic indications of the therapeutic strategies (i.e. Antibiotics, antivirals) or how to manipulate the immune response.

Knowledge and understanding

The course is mainly focused on the description of the main pathogens (i.e. Viruses, bacteria, parasites, etc.), their mechanisms of action, growth, infection and propagation. On the immunological side the course is focused on understanding cellular and molecular basis of the immune response, its regulation in physiology and pathology.

Applying knowledge and understanding

Through the theoretical and practical notions provided from the course, students should develop critical thinking skills and should be capable to autonomously deepen their knowledge and keep up to date of microbiology and immunology.
At the end of the course, students should fluently discuss all the learned notions, using the most appropriate terminology and should also be capable to communicate, with a simple but comprehensive and accurate language, the main informations about microbiology and immunology.

The Microbiology Course is a broad introduction to the world of infectious agents. The student will learn:
-how to classify pathogenic microorganisms and get familiar with differences in the genetic and functional organization of different pathogenic bacteria and viruses
-how to identify the causative agents of an infection
-how infections can be eradicated by antibacterial and antiviral drugs
-how infections could be prevented by vaccination

The Immunology Course will provide a view of cellular and molecular components of immune system and of the way they orchestrate pathogen control and physiological homeostasis maintenance. Students will acquire knowledge about:
- the molecular and cellular components of the immune system and the regulatory networks they organize
- the interaction between human tissues and microbial components and the way we recognize and counteract infections
- the main pathological alterations of immune cells and the way they mediate diseases

COURSE CONTENT/SYLLABUS

Microbiology

- The microbial world principles of classification. Bacteria: Structural and functional organization of bacterial cells. Inner and outer membranes, flagella, pili, cell-wall, capsulae Bacterial growth, antibacterial drugs.
- Antibiograms MIC MIB. Principles of bacterial identification Commensal, opportunistic and pathogenic microorganisms. Principles of bacterial pathogenesis. Endotoxins and exotoxins Fimbriae, adhesins biofilm formation. Contingency genes. Antigenic variation. Paradigmatic human pathogens: streptococci, staphylococci, chlostridia, enterobacteria, neisseriae, chlamydiae, pseudomonaceae
- Principles of classification of animal viruses. Detection of viruses and viral moieties. Viral diagnostics
- Paradigmatic RNA viruses: polio, FluA, HIV-1. Paradigmatic DNA viruses: herpes, papova. Early and late viral genes. Viral latency. Hepatitis viruses HAV, HBV, HCV, HDV. Biological life cycles of protozoa: toxoplasma, trypanosomes Plasmodia and malaria infections. Antiviral drugs. Classical and modern vaccines.
- Sporadic, endemic, epidemic and pandemic infections. Routes of transmission of infectious agents.
- Community and hospital acquired infections.

Immunology

- Cells and organs of the immune system. Recognition of pathogens: the innate and adaptive repertoire. Generation strategy of adaptive immune receptors: B and T Cell Receptors.
- Major Histocompatibility Complex (MHC); antigen processing and presentation; T cell restriction.
- Primary lymphoid organs and development of adaptive immune effectors.
- The innate-adaptive cell cross talk. Humoral and cell-mediated immune response. Immune tolerance mechanisms. Immune failure and pathogen persistence. Acute and chronic inflammation mechanisms.
- The derangement of tolerance control: hypersensitivity and autoimmunity. Allo-transplant recognition:
- Rejection and Graft Versus Host reaction. The tumour-immune response interplay.
- Primary Immune Deficiencies: molecular mechanisms and clinical outcomes.

TEACHING ACTIVITIES			
Week	**Day/Hour**	**Lessons/Seminars**	**Teacher**
1°W 03 and 05 March 2025	**Mon 03/03 14:30-17:00**	Immunology: Immune System: a general view.	Racioppi
	Wed 05/03 14:30-17:00	Immunology: Innate immunity and inflammation. The complement.	Racioppi
2°W 10 and 12 March 2025	**Mon 10/03 14:30-17:00**	Immunology: Innate and adaptive compartments: the recognition strategies.	Racioppi
	Wed 12/03 14:30-17:00	Immunology: The immune globulins and the T Cell Receptor: the generation of diversity.	Racioppi
3°W 17 and 19 March 2025	**Mon 17/03 14:30-17:00**	Immunology: Major Histocompatibility Complex and antigen presentation.	Matarese
	Wed 19/03 14:30-17:00	Immunology: The Bone Marrow and B cell development; the thymus an T cell development.	Ruggiero
4°W 24 and 26 March 2025	**Mon 24/03 14:30-17:00**	Microbiology: The Microbial word: an introduction. Structural and functional organization of bacterial cells.	Roscetto
	Wed 26/03 14:30-17:00	Microbiology: Microbiome and opportunistic pathogens - Steps of bacterial pathogenesis - Exotoxins and endotoxins	De Gregorio
5°W 31 March and 02 April 2025	**Mon 31/03 14:30-17:00**	Immunology: Immune Tolerance and Autoimmunity.	Matarese
	Wed 02/04 14:30-17:00	Immunology: Immune memory and vaccines; hypersensitivity reactions.	Ruggiero

6°W 07 and 09 April 2025	**Mon 07/04 14:30-17:00**	Microbiology: Animal viruses - general structural properties - virus replication cycle. Pathogenesis of viral infection.	Vitiello
	Wed 09/11 14:30-17:00	Microbiology: Antibacterial drugs - classification, mechanisms of action. Mechanisms of resistance of bacteria to antimicrobial drugs. Methods for determining sensitivity/resistance to antibacterial drugs.	Roscetto
7°W 14 and 16 April 2025	**Mon 14/04 14:30-17:00**	Immunology: Innate immunity.	Ruggiero
	Wed 16/04 14:30-17:00	Immunology: NK cells and Innate Lymphoid cells (ILC).	Matarese
8°W 23 April 2025	**Wed 23/04 14:30-17:00**	Immunology: Humoral and cell mediated adaptive response.	Ruggiero
9°W 28 and 30 April 2025	**Mon 28/04 14:30-17:00**	Microbiology: Paradigmatic RNA viruses: FluA, HIV-1. Paradigmatic DNA viruses: *Herpesviruses*, *Papovaviruses*.	Vitiello
	Wed 30/04 14:30-17:00	Microbiology:. Gram+ and Gram- pathogens: *Streptococcus* spp – morphological and metabolic characteristics, determinants of virulence, main clinical spectra. *Pseudomonas aeruginosa*-and *Haemophilus* spp morphological and metabolic characteristics, determinants of virulence, main clinical spectra.	De Gregorio
10°W 05 and 07 May 2025	**Mon 05/05 14:30-17:00**	Immunology: Primary Immune Deficiencies: molecular mechanisms and clinical outcomes.	Matarese
	Wed 07/05 14:30-17:00		Ruggiero
11°W 12 and 14 May 2025	**Mon 12/05 14:30-17:00**	Microbiology: Gram+ and Gram- pathogens: *Staphylococcus* spp – morphological and metabolic characteristics, determinants of virulence, main clinical spectra. *Enterobacteriaceae* - morphological and metabolic characteristics, determinants of virulence, main clinical spectra.	Roscetto
	Wed 14/05 14:30-17:00	Microbiology: Gram- pathogens: *Vibrio* spp – morphological and metabolic characteristics, determinants of virulence, main clinical spectra. *Helicobacter pylori* - morphological and metabolic characteristics, determinants of virulence, main clinical spectra.	De Gregorio

12°W 19 and 21 May 2025	**Mon 19/05 14:30-17:00**	Immunology: Immunity of Transplantation.	Ruggiero
	Wed 21/05 14:30-17:00	Immunology: Anti-tumor immunity.	Matarese
13°W 26 and 28 May 2025	**Mon 26/05 14:30-17:00**	Microbiology: Biological life cycles of protozoa. Classification of parasites. Case and clinical correlations.	Vitiello
	Wed 28/05 14:30-17:00	Microbiology: Principles of diagnostic microbiology - direct and indirect methodologies – molecular diagnosis.	Vitiello/De Gregorio/Roscetto

READINGS/BIBLIOGRAPHY

Sherris Medical Microbiology, Sixth Edition, 2014, McGraw-Hill.
Murphy et al. Janeway's Immunobiology, Eight Edition, 2011, Garland Science.
Lichtman, Pillai & Abbas, Cellular and Molecular Immunology, Eight Edition, 2014, Elsevier.
Parham, The Immune System, Fourth Edition, 2014, Garland Science.

Other supporting didactic material available at the web-site of Course Coordinator

TEACHING METHODS

The course will be based on lectures with the support of power points.

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	
only written	X
only oral	
project discussion	
other	

In case of a written exam, questions refer to: (*)	**Multiple choice answers**	X
	Open answers	
	Numerical exercises	

(*) multiple options are possible