

IMMUNOLOGY

Department of Genetics, Cell- and Immunobiology

Course Director: **Prof. Edit Buzás**

Credit: 3

Aim of the subject and its place in the curriculum:

A pre-clinical course for medical students that introduces the essentials of the immune system, natural and adaptive immune responses. It discusses the structure of the human immune system: organs, cellular and molecular components involved in the immune response; the development of genetic diversity of antigen receptors, and the role of diversity in an efficient immune response. It introduces to the students the processes of immunological regulation in healthy organism, including the immunology of pregnancy. It also discusses the course and alteration of immunological processes in certain pathological conditions, such as infections, tumors, hypersensitivity reactions, autoimmunity, immunodeficiency and transplantation, therefore provides a basis for other subjects. In related practices, students will be introduced to the basic methods required to test the functionality of the immune system, to the immunological assays and immunologically relevant procedures used in current diagnostics and therapy.

Competencies gained upon the successful completion of the subject: Understanding the relationships between immunological processes and the role of the immune system in the prevention, development and course of diseases. Theoretical knowledge of basic immunological diagnostic and therapeutic techniques.

Prerequisite(s) for admission to the subject:

Cell Science, Medical Biochemistry II.

Detailed thematic of the course:

	Lectures 2x45 minutes/week	Practices 1x70 minutes/week
1.	The role, processes, organs and cells of the immune system	Basic terms
2.	Principles of natural immunity	The role of the immune system in the lab
3.	The complement system; inflammation and acute phase reaction	Methods based on antigen-antibody interactions I. Immunoserology
4.	Antigen, antigen presentation and MHCs	Methods based on antigen-antibody interactions II:immuno-assays
5.	Antigen receptors and their formation	Methods based on antigen-antibody interactions III Flow cytometry
6.	T lymphocytes and cell-mediated immune response	Complement assays
7.	B lymphocytes and humoral immune response	Biological therapies I
8.	Immune response in infections	Biological therapies II
9.	Immunodeficiencies	Immunization and vaccination I
10.	Hypersensitivity reactions	Immunization and vaccination II
11.	Mucosal immunity	Hypersensitivity I.
12.	Immunological tolerance; natural and pathological autoimmunity	Hypersensitivity II-IV.
13.	Antitumor immunity	Screening methods for autoantibodies
14.	Immunology of transplantation and pregnancy immunity	HLA-typing

Policy regarding the attendance and making up absences:

Attendance of a minimum of 75% of the practices is necessary for the end-term signature. The presence at the seminars (practices) are registered weekly, more than three absences from the seminars invalidate the semester as well. The sessions can be attended in an appropriate mental and health condition.

Means of assessing the students' progress during the semester4: Discussing the topics of the lecture under the guidance of the practice teacher to establish diagnostic and therapeutic methods.

Requirement for acknowledging the semester (signature): Attendance of a minimum of 75% of the practices.

Type of the examination: written test

Exam requirements5:

The topics are based on the textbooks, the e-book, the lectures' and practices' presentations. At the exam, it is not sufficient to repeat memorized topics from the textbook and presentations, but you have to be able to synthesize and integrate your knowledge from different parts of the subject.

Topic list of lectures:

1. The concept of immunity, Principles of the immune response: antigen specificity, sensitivity, memory, clonal selection based operation.
2. Components (primary, secondary immune organs, cells, molecules) of the immune system.
3. Features of innate and adaptive, cell-mediated and humoral, primary and secondary response.
4. The immune homeostasis.
5. Migration of immune cells and adhesion molecules;
6. Cytokines and cytokine receptors.
7. Chemokines and chemokine receptors.
8. Fc-receptors; PAMP, DAMP, Pattern recognition receptors.
9. Phagocytes and phagocytosis.
10. Role of neutrophils, eosinophils and basophils/mast cells.
11. Types and role of dendritic cells.
12. Inflammasome/ inflammasomopathies.
13. Innate lymphoid cells.
14. The activation pathways and the regulation of the complement system;
15. Complement receptors;
16. Complement genetics;
17. The biological role of complement activation
18. The inflammation and the acute phase response, the provoking factors and mechanisms, periods;
19. The acute phase plasma proteins.
20. The major histocompatibility complex;
21. The ways of antigen processing and presentation.
22. Types and structures of antigen receptors;
23. The immunoglobulin and TCR genes, the sources of antigen receptor diversity;
24. Expression and production of antigen receptors.
25. Differentiation and activation of T cells
26. Types of the T cells
27. The cell mediated immunity.
28. The activation and differentiation of B cells
29. Types of the B-cells
30. The humoral immunity.
31. Antimicrobial immune response.
32. Mucosal Immunity
33. Hypersensitivity reactions: Type I-II-III-IV reactions
34. Immunological background of transplantation and GVH disease
35. The natural autoimmunity.
36. Idiotype regulation and network.
37. Pathological autoimmunity.
38. Mechanisms of immune tolerance.
39. Primary and acquired immune deficiencies.
40. Tumor antigens.
41. Anti-tumor immunity.
42. Escape strategies of tumor cells.
43. Possibilities of anti-tumor immune-therapy.
44. The immunology of pregnancy

Topic list of practices:

1. The cells and organs of immune system.
2. Communication between the immune cells.
3. Antigen and haptens.
4. Features of diagnostic antibodies.
5. Immunoserological techniques: Detection of antibodies in body fluids, or detection of antigens based on the antibody-antigen reaction.
6. Serum electrophoresis and densitograms,
7. Immune complex and immune precipitates.
8. Turbidimetry and nephelometry.
9. Methods based on immune precipitation: radial immunodiffusion, immunofixation.
10. Clinical application of immunoserology methods.
11. Direct, indirect and passive agglutination, methods based by agglutination, fields of use.

12. Features of diagnostic antibodies.
13. The labelling of diagnostic antibodies,
14. ELISA, Western blot. Immunocyto (histo)chemistry, fields of use.
15. Lateral flow test, fields of use.
16. Principles of flow cytometer and cytometry.
17. Identification of cell populations by size and granularity, scatter plot.
18. Immune phenotyping, histogram, dot plot.
19. Role of flow cytometry in clinical practice.
20. The ways of activation of complement system.
21. In vitro complement activation.
22. Measuring the complement activation (CH50).
23. Diseases of complement system. HAE disease.
24. HLA nomenclature.
25. HLA typing methods: Microcytotoxicity test and mixed lymphocyte culture test.
26. HLA associated diseases.
27. Definition of targeted molecular therapy and immune modulation.
28. Monoclonal antibodies in the therapy: Types of the monoclonal antibodies.
29. Monoclonal antibodies in the tumor therapy: checkpoint blockade, induction of ADCC, bispecific antibodies.
30. Antibody therapy in transplantation.
31. Antibody therapy in chronic inflammatory diseases.
32. TNF alpha, T- and B cells as therapeutic targets in RA.
33. IVIG
34. Cytokine therapy
35. Dendritic cell-therapy.
36. The aims and practical implementation of immunization.
37. Adjuvants.
38. Immunodominant epitope.
39. Oral tolerance.
40. The aim of immune stimulation, active immunization.
41. Passive immunization
42. The features of effective vaccines.
43. Types of vaccines, cell-based vaccination
44. Hypersensitivity reactions I.: Penetration of antigens, types of IgE mediated responses.
45. Release of histamine and its effects.
46. Allergy tests.
47. Immune Anaphylaxis vs. Non-immune anaphylactoid reaction; urticaria vs. angioedema.
48. Food intolerance vs. food allergy.
49. Basics of allergy pharmacotherapy; Desensitization and prevention.
50. Clinical examples for Hypersensitivity reactions II-III-IV.
51. Diagnostic tests used in Hypersensitivity reactions II-III-IV.
52. Types of systemic and organ specific autoantibodies
53. Screening methods of autoantibodies,
54. Detection of autoantibodies.

Literature, i.e. printed, electronic and online notes, textbooks, tutorials (URL for online material):

Abul Abbas, Andrew Lichtman, Shiv Pillai, Basic Immunology 6th Edition, Elsevier, 2019.
 Practice and lecture ppt-s): <http://gsi.semmelweis.hu>
 Immunology seminars (e-book): <http://gsi.semmelweis.hu>