

English speaking students Medical Faculty 1st year

IMMUNOLOGY COURSE

Programme:

1. Introduction to the immune system. Innate humoral immunity. Seminar 1 and 2 (26-28.11.2025)

Immunity: innate and adaptive, active and passive, specific and nonspecific, natural and artificial, cellular and humoral. Immunity and immune response.

The lymphoid system: primary (central) and secondary (peripheral) lymphoid organs, circulation of lymphocytes.

Cells of the immune system and their functions: stem cells, B, T, NK lymphocytes, macrophages, granulocytes, dendritic cells, mast cells, platelets. Soluble mediators: complement, antibodies, cytokines, interferons, inflammatory mediators.

Innate immunity: exterior defences and physical and biochemical barriers, the role of normal flora, nonspecific factors humoral (complement, interferones, lysozyme, lactoferrin, C-reactive protein, heat shock proteins..) and cellular (mononuclear and polymorphonuclear phagocytes, NK cells). Complement: classical and alternative pathways, biological effects (vascular permeability increasing, chemotaxis, neutrophils activation, opsonization, lysis). Complement receptors.

Practical class 1 (01-05.12.2025):

Film: The immune system.

Analysis of blood smears and identification of white blood cells in light microscopy.

Testing of complement- detection of particular components: C3, C4, C1 inhibitor, B, P factors and testing of activity: 50% - hemolysis of a standardized antibody-sensitized erythrocytes - CH50.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 1, chapter 4. **Test 1**

2. Innate cellular immunity. Seminar 1 and 2 (26-28.11.2025)

Phagocytosis: migration and chemotaxis of phagocytes, adhesive molecules (integrins, selectins), chemotactic factors (complement proteins, chemokines), phagocytes receptors, opsonization, ingestion, digestion (killing), oxygen-dependent and oxygen-independent killing activity. Pathological barrier - inflammation.

Natural cytotoxicity - NK cells characteristic and function.

Practical class 2 (08-12.12.2025):

Film: Local pulmonary defense mechanism.

Estimation of chemotaxis - agarose method.

Assays for phagocytic cells - percentage of phagocytes, index of phagocytosis, index of killing, NBT (nitrobluetetrazolium test)

Analysis of blood smears and identification of white blood cells in light microscopy.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 1, chapter 2, section 2, chapters 6,7,10

Test 1 (08-12.12.2025)

3. Adaptive cellular immunity. Seminar 3 (01-05.12.2025)

Antigen, hapten, chemical structure, thymus-dependent and thymus-independent antigens, heterophilic antigens, cross-reactivity, superantigens. Antigenic determinants - epitopes, immunogenicity, specificity.

The main phases of the immune response: induction (recognition of antigen), central phase (activation, clonal selection and proliferation of T and B lymphocytes), effector phase (antigen elimination mediated by antibody and effector cells).

Lymphocytes: subpopulations: B (B1, B2), T (Th1, Th2, Ts, Tc), NK, NC, CD markers, receptors for antigen (B - Ig, T - TCR), circulation of lymphocytes.

Processing and presentation of antigen, antigen presenting cells.

Adaptive cellular response: cell-mediated cytotoxicity (recognition of antigen: T CD8 - I class MHC restriction), delayed type of hypersensitivity (T CD4 - II class MHC restriction, effector phase - activated macrophage)..

Practical class 3 (15-19.12.2025):

Film: Cellular mechanisms of the immune response.

Estimation of number and function of T and B lymphocytes: isolation of lymphocytes, detection of the CD markers (rosetting tests: E, EA, EAC, differentiation of lymphocytes using IF, flow cytometry), lymphocytes function testing (activation and proliferation after PHA, migration inhibitory test, concentration of cytokines, cytotoxic tests).

Source: D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 1, chapter 5, section 2 chapters 8,10

Test 2 (15-19.12.2025):

4. Adaptive humoral immunity. Seminar 4 (08-12.2025)

Adaptive humoral response: B lymphocytes recognition, T and B cooperation in the antibody response, plasma cells - antibody production, primary and secondary humoral response.

Antibodies: structure, Fab and Fc role, sequence differences (isotypic, allotypic, idiotypic, paratop), biological functions, Fc receptors on cells, monoclonal and idiotypic antibodies, specificity, affinity, avidity, cross-reactivity. Types of immunoglobulins.

Antigen-antibody interactions: in vivo - neutralization, immunological complexes, opsonisation, lysis; in vitro - agglutination, precipitation.

Cooperation of specific humoral and cellular response: immunophagocytosis, antibody dependent cellular cytotoxicity (ADCC) - NK CD16, macrophages, neutrophils

Useful (defense against infections, pre-cancer growth control) and damaging (allergy, autoimmunity, transplant rejection) effects of specific response.

The immune system of skin and mucosa- SALT, MALT- GALT, NALT, BALT -similarity and diversity, food tolerance.

Regulation of the immune response (the role of complement, antigen, immunoglobulins, T-cell antigen receptors, idiotypic antibodies). Neuroendocrine-immuneinteractions. Immunological tolerance, mechanisms. The cytokine network

Practical class 4 (08-14.01.2026):

Film: Antibody structure and the generation of diversity

Immunoglobulins classes (IgG, IgM, IgA) - estimation of the levels in serum with radial immunodiffusion method.

Observation of effects of antibody function: lysis - lytic test, immunocomplexes - ring precipitation. Detection of specific

antibodies and antigens in serological tests in vitro: slide and tube agglutination, passive haemagglutination, lytic test, complement fixation, ring precipitation, double gel diffusion, radial diffusion, direct and indirect immunofluorescence, Elisa, RIA, immunoblotting.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 1, chapter 3, section 2, chapters 9,11

Test 3 (08.01-14.01.2025)

5. Immunity against infections. Seminar 5 (15-19.12.2025)

Phylogeny and ontogeny of the immune system: development and maturation of the immune system: fetus, newborn, child, adult, old age, immunobiology of aging. Species - dependent, individual and other factors affecting immunity.

Immune response to different antigens. Types of infections and parasites: obligatory intracellular parasites, facultative intracellular parasites, extracellular parasites.

The role of particular mechanisms of specific and nonspecific defense in infections caused by: bacteria (immune response to extracellular and intracellular bacteria, bacterial evasion of host-defense mechanisms), fungi, viruses (viral neutralization by antibodies, cell-mediated and humoral antiviral mechanisms), protozoa and worms.

Practical class 5 (15-21.01.2025):

Film: Infectious disease.

The results of serological tests in different infections: *Helicobacter pylori*, *Borrelia burgdorferi*, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 3, chapters 13,14,15

Test 4 (15-21.01.2026, includes the issues from practical class 4 and class 5)

6. Immunological diagnostics-summary. Seminar 6 (08-14.01.2026)

Basic and combined serological assays - procedure, mode of action, result interpretation, advantages and disadvantages: slide and tube agglutination, ring precipitation, double gel diffusion, radial diffusion, lytic test, complement fixation test, IF, RIA, Elisa, immunoblotting.

7. Hypersensitivities. Seminar 7 (15-21.01.2026)

Mechanisms of hypersensitivity. Early reactions: type I - anaphylaxis, allergens, IgE antibody, IgE receptors, involved cells (mast cells, basophiles), mediators, clinical effects (hay fever, asthma, eczema, anaphylaxis); type II - cytotoxic and cytolytic reactions (posttransfusion, drug-induced reactions); type III - immune-complex diseases (Arthus reaction, serum sickness); late reactions: type IV - tuberculin (bacterial allergy, contact hypersensitivity)

Practical class 6 (22-28.01.2026):

Description and interpretation of test used in diagnostics of allergic diseases: estimation of total and specific IgE levels in vitro - RIST and RAST tests, basophiles degranulation test, detection of histamine released from basophiles, detection of triptase, demonstration of eosinophils in bronchoalveolar lavage (BAL) preparations. Skin tests- late hypersensitivity in people - Multitest, prick-tests.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., Section 5 **Test 5 (22-28.01.2025)**

8. Immunoprophylaxis, immunomodulation, immunotherapy. Seminar 8 (22-28.01.2026)

Active immunization: types of vaccines - whole organisms inactivated and attenuated, purified molecules (toxoids, capsular polysaccharide, surface antigens), recombinant antigen vaccines, DNA vaccines; recommended vaccinations, vaccinations in risk groups. Adjuvants. Non-specific vaccines and immunotherapy (cytokines).

Passive immunization: indications, complications.

Active immunization: types of vaccines - whole organisms inactivated and attenuated, purified molecules (toxoids, capsular polysaccharide, surface antigens), recombinant antigen vaccines, DNA vaccines; recommended vaccinations, indications and contraindication and side effects. Vaccinations in groups of risk. Adjuvants - mechanism of action. Recommended vaccines - group of risk

Passive immunization: indications, complications.

Desensitization: vaccines used in the atopic diseases.

Non-specific vaccines and immunotherapy (cytokines).

Nonspecific immunotherapy (bacterial, plantal, cytokines), immunosuppression.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 3, chapter 18

9. Organ transplantation and graft rejection- Seminar 9 (29.01-04.02.2026)

Transplantation immunology: general organization and inheritance of the MHC/HLA complex, transplantation antigens HLA class I and II, bone marrow transplants, organ transplants, relationship between the donor and recipient, immunologic mechanisms involved in allograft rejection graft-versus-host response (GVHD).

HLA antigens and susceptibility to diseases.

Practical class 7 (29.01-04.02.2026).

Film: Transplantation

HLA antigens class I and II typing: serological methods, molecular methods (PCR-SSP, PCR-SSO). Lymphocytotoxic test (LCT).

Donor-recipient matching.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 4, chapter 21 **(included in the final exam)**

10. Tumor immunology and immunology of reproduction. Seminar 10 (05.02-11.02.2026)

Cancer and the immune system: malignant transformation of cell, oncogenes and cancer induction, tumor antigens, differentiation of tumor-antigens, human immune response to tumor and escape mechanisms. Immunotherapy of tumors.

Immunology of reproduction: immunological base of infertility in man and woman, gravidity as an allogenic transplant, pregnancy maintenance, pregnancy loss, immunotherapy of recurrent abortions.

Practical class 8 (05-11.02.2026):

Film: Monoclonal antibodies.

Coombs test - direct and indirect. Immunoprophylaxis of Rh (-) women; administration of anti-D immunoglobulin.

Antisperm antibodies in IF method.

Estimation of cytotoxicity of NK cells - microscopy prepare.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 4, chapter 22 **(included in the final exam)**

Recommended textbook:

David Male, Jonathan Rostoff, David B Roth, Ivan M Roitt, **Immunology**, 8th Edition