Programme:

1. Introduction to the immune system. Innate immunity I (humoral).
   Immunity: innate and adaptive (acquired), active and passive, specific and nonspecific, natural and artificial, cellular and humoral.
   Immune and immune response.
   The lymphoid system: primary (central) and secondary (peripheral) lymphoid organs, circulation of lymphocytes.
   Innate immunity: exterior defences and physical and biochemical barriers, the role of normal flora, nonspecific factors humoral (complement, interferones, lysozyme, lactofferine, 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
   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.
   Sources:
   1. Lippincott's illustrated reviews: Immunology, chapters 3-5, chapters 6.VI, 7
   2. Roitt, Brostoff, Male, Immunology, chapter 4

2. Innate immunity II (cellular).
   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
   Film: Local pulmonary defense mechanism.
   Estimation of chemotaxis – agarose method.
   Assays for phagocyte 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.
   Sources:
   1. Lippincott's illustrated reviews: Immunology chapter 13.IV
   2.Roitt, Brostoff, Male, Immunology, chapters 3,5
   3. Campbel et al., NK cells biology, an update and future directions. J Allergy Clin Immunol 2013, 132(3); 536-44

   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.

   Practical class
   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).

Sources:
2. Roitt, Brostoff, Male, Immunology, chapters 7, 10
3. Chen et al., Molecular mechanisms of T cells co-activation and co-inhibition, Nat Rev Immunol 2013(4); 227-242


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.


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

Usefull (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, BAL –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
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.

Sources:
2. Roitt, Brostoff, Male, Immunology, chapters 3, 11,13
3. Annunziato et al., The 3 major types of innate and adaptive cell-mediated immunity. J Allergy Clin Immunol, 2015(3);626-35

5. Immunological diagnostics.

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.

Practical class
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 direct immunofluorescence, Elisa, RIA, immunoblotting.

Sources:
1. Lippincott’s illustrated reviews, chapter 20
2. Roitt, Brostoff, Male, Immunology, chapter 29


Phylogenesis and ontogenesis 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 immunitaffecting factors.

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

The role of particular mechanismsof 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 antibody, cell-mediated and humoral antiviral mechanisms), protozoa and worms.

Practical class
Film: Infectious disease..

The results of serological tests in different infections: Helicobacter pylori, Borrelia burgdorferi, Mycoplasma pneumoniae, Chlamydia pneumoniae.
Sources:
1. Lippincott’s illustrated reviews: Immunology, chapter 13.1-III
2. Roitt, Brostoff, Male, Immunology, chapters 12,16,17

7. Hypersensitivity.
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
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..
Sources:
1. Roitt, Brostoff, Male, Immunology, chapters 23-36

8. Autoimmunity.
Immunological memory and tolerance.
Positive role of IgE, autoimmunity and tolerance.

Practical class
Film. Autoimmune disease.
The rules of autoimmune diseases diagnostics - autoantibodies detection- IF method, ELISA, Western -blot and immune complexes detection.
Student of reports -characteristics of individual autoimmune diseases (clinical symptoms, patomechanism, diagnostics and treatment)
Sources:
1. Lippincott’s illustrated reviews: Immunology, chapter 16
2. Roitt, Brostoff, Male, Immunology, chapter 28

9. Primary and secondary immunodeficiencis
Primary immunodeficiencies: B-cell dependent, T-cell dependent, defects in complement proteins and in phagocytes.
Secondary immunodeficiencies: caused by drugs, nutrition, other diseases (AIDS).
Infections typical for different types of immunodeficiency.

Practical class
Student of reports -characteristics of individual deficiency diseases (clinical symptoms, patomechanism, diagnostics and treatment)
Sources:
1. Lippincott’s illustrated reviews: Immunology, chapter 15
2. Roitt, Brostoff, Male, Immunology, chapters 21-22

10. Transplantation and graft rejection
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
Film: Transplantation
HLA antigens class I and II typing: serological methods, molecular methods (PCR-SSP, PCR-SSO). Lymphocytotoxic test (LCT). Donor-recipient maching.

Sources:
1. Lippincott's illustrated reviews: Immunology, chapter 17
2. Roitt, Brostoff, Male, Immunology, chapter 27

11. Immunoprophylaxis, immunomodulation, immunotherapy.
   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.
   Autovaccines – indications, way of administration.
   Desensitization: vaccines used in the atopic diseases.
   Non-specific vaccines and immunotherapy (cytokines).
   Nonspecific immunotherapy (bacterial, plantal, cytokines), immunosupression.

Practical class
   Autovaccines – indications and contraindications, principles of treatment.

Sources:
1. Lippincott's illustrated reviews: Immunology, chapter 18
2. Roitt, Brostoff, Male, Immunology, chapter 19

12. Tumor immunology and immunology of reproduction. Immunological diseases diagnostic procedures.

   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
   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 preparet.

Sources:
1. Lippincott's illustrated reviews: Immunology, chapter 19
2. Roitt, Brostoff, Male, Immunology, chapter 20

13. Diagnostic of immune diseases – case reports
   Analysis of clinical cases with immunological disorders.
   4th term of retake

Recommended textbooks:
- Immunology, I. Roitt, J. Brostoff, D. Ihale, Mosby, 5th ed.
- Immunology, R. M. Hyde, 3rd or 4th edition, NMS
- **Immunology**: Introductory Textbook, Shetty, Nandini, 2005
- **Review of Medical Microbiology and Immunology**, 11e Warren Levinson
- **Schaum's Outline of Immunology**, Pinchuk, George