

English speaking students 2nd year of Medical Faculty

IMMUNOLOGY COURSE Department of Diagnostic Immunology

Programme:

1. Organization of immunology classes. Formal issues.

2. Introduction to the immune system. Innate humoral immunity.

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, interferons, 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:

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.

3. Innate cellular immunity.

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 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

4. Adaptive cellular immunity.

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:

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

5. Adaptive humoral immunity.

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:

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.

Source:

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

6. Organ transplantation and graft rejection- seminar.

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 matching.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 4, chapter 21

7. Hypersensitivities and allergies.

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.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., Section 5

8. Principles of inborn errors of immunity.

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:

Summary of presented diagnostic assays in the context of IEI diagnostics.

Source:

D. Male, J. Brostoff, D. Roth, I.M. Roitt, Immunology 8th Ed., section 3, chapter 16,17

Recommended textbook:

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