

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

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. 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

8. 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

Recommended textbook:

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