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IMMUNOPATHOLOGY COURSE

TERMS GLOSSARY

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IMMUNOPATHOLOGY TERMS GLOSSARY (A-Z)

A

- **Activation phase:** The second phase of the immune response in that lymphocytes which recognize and bind a foreign antigen undergo initial proliferation to become cloned memory cells and to amplify the protective response. B-cells then differentiate into clones of antibody-producing plasma cells.
- **Allergen:** Any substance capable of inducing an allergic reaction.
- **Allergy:** A clinically manifest hypersensitivity state to a specific allergen or antigen causing a range of harmful immunologic reactions, (e.g., hay fever, asthma, food intolerance, skin rash).
- **Anaphylactic reaction:** Sudden generalized allergic reactions of life-threatening severity.
- **Anaphylatoxin:** A fragment (also known as C3a) of complement C3 that causes cellular release of histamine.
- **Antibody:** An immunoglobulin protein produced by the immune system, designed to bind to a specific single antigen. Antibodies neutralize foreign antigens; form immune complexes; activate complement; sensitize target cells, mast cells, and basophils; and initiate opsonization.
- **Antigen:** Any substance (or molecule) capable of inducing a specific immune response. Antigens include a wide variety of plant and microorganism components or toxins.
- **Arthus reactions:** Dermal skin test reactions (characteristic of Type III hypersensitivities), that occur during a 4–12 h interval.
- **Autoimmune disease:** Any disease caused by the immune system's erroneous and destructive actions on the body's own tissues, such as thyroiditis, myocarditis, glomerulonephritis, and lupus erythematosus.

B

- **Basophil:** A white blood cell (WBC) with granules that can be stained by basic dyes. Basophils participate in inflammatory processes and in allergic and hypersensitivity reactions by releasing histamine.
- **B-cells (or B-lymphocytes):** Thymus-independent, bursa-equivalent lymphocytes produced by bone marrow to populate all lymphoid organs and tissues. They are capable of producing antibodies and maturing into plasma cells. B-cells express antibody on their surfaces that can respond to foreign protein, polysaccharide, and lipid antigens in soluble form.

C

- **Cathepsin:** A proteinase enzyme released by polymorphonuclear leukocytes during inflammation.
- **Cell-mediated immunity :** Antigen-specific and nonspecific immunity provided by the direct localized cellular activity of T-lymphocytes and natural killer cells. Specific cells include T-helper cells (Th) and T-cytotoxic cells (Tc); nonspecific cells include macrophages, neutrophils, eosinophils, and NK-cells.
- **CD4+ cells:** Helper T-cells recognized by the presence of cluster of differentiation antigen 4 on their exterior cell surfaces.
- **CD8+ cells:** Suppressor T-cells recognized by the presence of cluster of differentiation antigen 8 on their exterior cell surfaces.

- **Chemotaxis:** The purposeful movement of phagocytes toward invading bacteria, cell debris, or foreign particles.
- **Cognitive phase:** The phase of the immune response in which foreign antigens are bound to specific receptors on mature lymphocytes.
- **Colony Stimulating Factors:** Cytokines that stimulate the generation of additional white blood cells. These have been produced by biotechnology and are available for therapeutic or investigative use.
- **GCSF:** Granulocyte colony stimulating factor.
- **GMCSF:** Granulocyte macrophage colony stimulating factor.
- **MCSF:** Monicyte colony stimulating factor
- **Complement system:** A group of plasma proteins that interact to form complement, an important mediator of inflammation. Active complement fragments play important roles in both nonspecific and cell-mediated immunity.
- **C-reactive protein:** An acute-phase reactive glycoprotein widely used as a clinical indicator of acute-phase reactions.
- **Cytokines:** Small peptide molecules released by a variety of cells. Acting in the nature of hormones, apocrines, and/or paracrines, they allow intercellular communication and stimulate a diverse variety of responses by target cells. Cytokines include, but are not limited to, interleukins, interferons, and colony stimulating factors.

D

- **Defensins:** Basic polymorphonuclear leukocyte proteins released during inflammation that kill bacteria by damaging their cell walls.
- **Delayed hypersensitivity:** An exaggerated immune response that is delayed for a day or more. It is mediated by the response of T-cells to a foreign antigen or allergen.
- **Discrimination of self from nonself:** A remarkable feature of the immune system that enables it to distinguish between foreign antigens and self-antigens. Tolerance to self-antigens is acquired by individual lymphocytes. If the tolerance process becomes defective, autoimmune diseases may develop.
- **Diversity:** Immune system diversity constitutes the entire, extremely large number of different antigens that can be recognized.

E

- **Effector phase:** The third phase of the immune response in which multifaceted mechanisms become focused on the elimination of the foreign antigen. Antibodies bind to the antigen to enhance its elimination by phagocytes, to activate the complement cascade, to stimulate mast-cell degranulation, and to assist in the inflammatory reaction. Cytokines are released to enhance the immunological reaction, recruit phagocytic cells, and induce generalized acute-phase reactions.
- **Eicosanoids:** Small lipid molecules derived from polyunsaturated fatty acids (contained in cellular plasma membranes) that initiate a diverse variety of cellular and physiological activities. Eicosanoids include families of prostaglandins, thromboxanes, leukotrines, and so forth.
- **Enzyme-linked immunosorbent assay (ELISA):** A sensitive method for serodiagnosis of specific infectious diseases; an in vitro competitive binding in which an enzyme and its substrate, rather than a radioactive substance, serve as the indicator system.

- **Eosinophil:** A white blood cell with granules that can be stained by eosin dyes. Eosinophils participate in allergic and hypersensitivity reactions.
- **Epitopes (or determinants):** The precise molecular configurations of an antigen that can be recognized by an individual lymphocyte.

F

- **Fab (antibody fragment) parts:** The two arms of Y-shaped antibody molecules that bind to a specific antigen.
- **Fc (crystalline fragment) part:** The bottom leg of Y-shaped antibody molecules that can bind to complement or various WBCs.

H

- **Haptoglobin:** A plasma glycoprotein, also an acute-phase reactant, that functions to bind and inactivate (detoxify) free hemoglobin.
- **Helper cell:** A CD4+ T-lymphocyte that helps initiate and stimulate the production of immunoglobulins by B-cells or plasma cells. Also provides help to Tc-cells.
- **Histamine:** A small amine compound, C5H9N3, released by mast cells during allergic reactions, which causes dilation of blood vessels, bronchoconstriction, itching, and other symptoms.
- **Humoral immunity:** Antigen-specific immunity mediated by B- and plasma-cell production of circulating or secretory immunoglobulins.
- **Hypersensitivity reaction:** An allergic response to an allergen or antigen.

I

- **Immediate hypersensitivity:** Exaggerated immune response to a foreign allergen or antigen induced largely by the release of histamine and occurring within minutes.
- **Immune responses:** The humoral and cell-mediated responses of the immune system to antigens. These responses occur in three distinct phases (cognitive, activation, and effector phases) and exhibit five cardinal properties, or features (specificity, diversity, memory, self-limitation, and discrimination of self from nonself).
- **Immunity:** High protective resistance to a disease threat that is produced by the immune system or by some other nonspecific protective mechanism.
- **Immunoglobulin:** An antibody of one of several types (IgA, IgD, IgE, IgG, IgM).
- **IgA:** A mature polymeric immunoglobulin secreted in response to antigens on mucosal and epithelial surfaces, and the precursor of secretory IgA, possessing the primary four-chain structure typical of IgG. Its normal concentration is 3 mg/mL serum.
- **IgD:** An immunoglobulin intrinsic to the surface of B-cells that, when contacted by a specific homologous antigen, initiates B-cell proliferation (cloning), differentiation, and antibody production. Normal IgD concentration in serum is 0.03 mg/mL.
- **IgE:** An antibody that can sensitize mast cells and basophils during allergic reactions, causing them to release histamine and other inflammatory mediators. Normal IgE concentration is 0.0001 mg/mL serum.
- **IgG:** The mature antibody of the humoral immune response, possessing the primary molecular structure described above. Normal IgG concentration in serum is 12 mg/mL.

- **IgM:** The initial antibody produced during a humoral immune response. IgM is a large polymer consisting of five of the primary Y-shaped antibody structures connected by a J-chain. Normal IgM concentration in serum is 1 mg/mL.
- **Secretory IgA:** An IgA dimer (two IgAs connected by a J-piece) to which a secretory piece has been added by an epithelial cell prior to IgA secretion into a body fluid such as tears, milk, or saliva. Although the serum concentration of IgA is lower that of IgG, far more IgA is actually produced each day because it is constantly being secreted into body fluids.
- **Interferon:** Cytokine that interferes with the propagation of viruses and fills other immunological roles. INF-α is produced by phagocytic leukocytes, INF-β by fibroblasts, and INF-γ by lymphocytes.
- **Interleukin:** Cytokine that permits communication among white blood cells and other tissues. Interleukins include the following:
- **IL-1** (endogenous pyrogen, leukocytic endogenous mediator, lymphocyte activating substance): A proinflammatory cytokine with scores of reported activities, including the generation of fever, skeletal muscle proteolysis, and metabolic wasting. IL-1 also enhances the proliferation of T-helper and B-cells.
- **IL-2** (T-cell growth factor): A lymphokine derived from helper cells, predominantly responsible for T-cell proliferation, the generation of lymphokine activated killer (LAK) cells, and the activation of B-cells.
- **IL-3** (multicolony stimulating factor): A cytokine derived from monocytes, fibroblasts, and endothelial cells that increases the production of monocytes.
- **IL-4** (B-cell differentiating factor, T-cell growth factor-2): A lymphokine that stimulates both T- and B-cells.
- **IL-5** (B-cell growth factor-2, eosinophil-differentiating factor): A lymphokine that activates B-cells and eosinophils.
- **IL-6** (B-cell stimulatory factor-2, interferon-β2): A proinflammatory cytokine with many diverse actions, including stimulation of hepatocellular responses during the acute-phase reaction.
- **IL-7** (lymphopoietin I, pre-B-cell growth factor): A cytokine that stimulates proliferation of both B- and T-cells.
- **IL-8** (neutrophil-activating peptide, neutrophil chemotactic [or chemoattractant] factor): A proinflammatory cytokine produced by numerous cell types that also causes chemotaxis of polymorphonuclear leukocytes.
- **IL-9** (P40, mast-cell growth-enhancing factor, T-cell growth factor-3): A lymphokine that stimulates growth and proliferation of T-cells and mast cells.
- **IL-10** (cytokine synthesis inhibitory factor): A cytokine produced by various cells that inhibits T-cell production of INF-γ and the synthesis of monokines by macrophage or monocytes.
- **IL-11** (adipogenesis inhibitory factor): A cytokine produced by marrow stromal cells that stimulates the hepatic synthesis of acute-phase glycoproteins.
- **IL-12** (NK-cell stimulating factor, cytotoxic lymphocyte maturation factor): A cytokine that induces INF-γ gene expression in lymphocytes.
- **IL-13** (P600): A lymphokine that inhibits the synthesis of proinflammatory cytokines by monocytes and other cells.
- **IL-14** (high molecular weight B-cell growth factor): A lymphokine that stimulates B-cell proliferation while inhibiting antibody production.
- **IL-15** (no prior common name): A lymphokine that stimulates T-cell proliferation and NK-cell activation.

L

- **Lymphocyte repertoire:** The more than 109 distinct antigenic determinants (epitopes) that can be recognized by antigen-specific clones of human lymphocytes.
- **Lymphokine:** A cytokine secreted by a lymphocyte.
- **Lysozyme:** An enzyme present in tears and body secretions and fluids that helps in the destruction of bacterial cell walls.

M

- **Macrophages:** Large mononuclear tissue phagocytes that secrete cytokines when activated and interact with T-cells in processing and presenting antigens to B-cells. They are termed monocytes when bloodborne.
- **Major histocompatibility complex haplotypes:** Genetically controlled proteins on cell surfaces that indicate its specific tissue type. The cellular HLA (human leukocyte antigen) locus is expressed by at least four blocks of genes. A correct arrangement and recognition of MHC surface proteins is necessary for direct cell-to-cell contact between antigen-presenting cells and lymphocytes and for the identification of nonforeign body cells. Two classes of MHC molecules exist, each containing two polymorphic polypeptide chains that traverse the cell membranes of body cells. Molecular transcription rates of both MHC classes are influenced by cytokines, thus providing an important amplification mechanism for T-cell responses. Both classes were originally recognized for their role in triggering rejection of transplanted tissues, but their larger roles in forming complexes with diverse kinds of foreign protein antigens is now known. **Class I MHC molecules** are expressed on virtually all nucleated body cells. MHC molecules of both types possess peptide-binding, Ig-like, transmembrane, and cytoplasmic regions. The peptide-binding regions of both types are the principal determinants of the specificities and affinities of peptide antigens that can be bound, wherever the Ig-like regions appear to be important for noncovalent interactions between the two molecular chains. Antigens associated with Class I MHC molecules are recognized by CD8+ T-suppressor lymphocytes. **Class II MHC molecules** are expressed primarily on cells involved in the presentation of foreign antigens (i.e., lymphocytes, macrophages, dendritic cells, endothelial cells, etc.). In contrast to Class I molecules, Class II molecules show differences in cell expression and cytokine responsiveness among these cell types. Class II-associated molecules are recognized by CD4+ T-helper cells.
- **Memory:** The exquisite recall exhibited by the immune system that enables it to mount a more vigorous and effective response whenever it is restimulated by a specific foreign antigen.
- **Memory cells:** Lymphocytes that have previously responded to a specific antigenic stimulus. They survive for exceedingly long periods and can respond rapidly to the same antigen.
- **Monocyte:** A large white blood cell with a single nucleus, with phagocytic, cytokine-producing, and antigen-processing capabilities. Tissue forms are called macrophages.
- **Monokine:** A cytokine secreted by a monocyte or macrophage.

N

- **Neopterin:** A small protein produced by monocyte–macrophages (often in combination with IL-6 and other proinflammatory cytokines) that has immunosuppressive properties.
- **Neutrophil:** The most numerous of the white blood cells (also called polymorphonuclear leukocytes). The principal cellular participant in inflammatory reactions, neutrophils act by engulfing and destroying microbial invaders, cell debris, and particulate matter.

- **Nitric oxide:** A multifunctional molecule derived from arginine that has microbicidal and parasiticidal properties.
- **NK (natural killer) cells:** Specialized T-cells with the continuous task of identifying and eliminating cells recognized as being foreign or nonself. Large, granular NK-lymphocytes can mediate antibody-dependent cellular cytotoxity as well as lysing target cells (tumor cells and modified host cells.
- **Nonspecific immunity:** Resistance against disease threats produced by diverse physiological mechanisms that do not require the recognition of or response to specific antigens.
- **Null cells:** Lymphocytes lacking the surface CD markers of the principal lymphocyte subsets.

O

- **Opsonins:** Constituents of serum that bind to antigens, making invading microorganism more susceptible to the destructive action of phagocytes.
- **Opsinization:** The process of altering bacterial walls to increase susceptibility to phagocytosis.
- **Orosomucoid:** An acute-phase reactant plasma glycoprotein, α1-acid glycoprotein.
- **Oxidative burst:** Sudden uptake and utilization of oxygen by phagocytic cells (neutrophils, monocytes, macrophages) whenever they engulf a bacterium or other foreign particle.

P

- **Phagocyte:** A blood cell that ingests and destroys foreign particles, bacteria, and cell debris.
- **Phagocytosis:** The process of engulfing particles, bacteria, and cell debris.
- **Phytohemagglutinin (PHA):** A plant mitogen that stimulates T-lymphocytes.
- Plasma cells: Antibody-producing cells that have matured from antigen-stimulated B-cells.
- **Pleiotropy:** Ability to exert multiple effects.
- **Proinflammatory cytokines:** Cytokines that are especially linked to the production of inflammatory processes and acute-phase responses. They include IL-1, IL-6, IL-8, TNF, and INF-γ.
- **Properdin:** A nonimmune gamma-globulin that can be activated to a convertase enzyme, which in turn causes activation of the alternative pathway of the complement system.

R

- **Respiratory burst:** A sudden increase in cellular respiration that occurs when phagocytes become activated. This process generates free oxygen radicals with microbicidal properties.

S

- **Self-limitation:** The waning over time of immune responses to antigenic stimulation.
- **Siderophores:** Iron-binding proteins secreted by bacteria that gather the iron needed for bacterial growth. Siderophores compete with mammalian iron-binding proteins for the iron they carry.
- **Specificity:** Property of the immune system that enables it to recognize and respond to each of the myriads of foreign, molecularly unique antigens encountered throughout an individual's lifetime. Suppressor cell. A CD8+ T-lymphocyte that helps control (suppress) an excess production of specific immunoglobulins.

T

- **T-cells** (or T-lymphocytes): Thymus gland-dependent lymphocytes responsible for the development and maintenance of cell-mediated immunity. T-cells recognize only short peptide sequences on intracellular protein antigens expressed on cell surface membranes; T-cells may exert a helper, suppressor, or effector function.
- **Thymosin:** A zinc-containing hormone produced by stromal cells of the thymus gland that abets the actions of T-cells throughout the body.
- **Tumor necrosis factor** (cachexin, lymphotoxin): Cytokine with action closely similar to IL-1. In addition, TNF stimulates cytotoxicity by PMN and eosinophils and inhibits the activity of lipoprotein lipase.

U

Urticaria: Itchy dermal wheals caused by type I hypersensitivity reactions.