

Terms used in First Three Classes
October 20, 2020

adaptive immunity: The adaptive system consists of B cells and T cells, which respond to specific features of a pathogen.

ADCC (Antibody Dependent Cellular Cytotoxicity): the killing of a target cell that occurs by the following process. An antibody binds to a target cell and then a natural killer (NK) cell binds to the Fc part of the antibody and the NK cell releases its toxic chemicals to kill the target cell

Adoptive transfer of T cells: A therapy approach for cancer in which a patient's T cells are removed from the body, modified to become more potent, and expanded in number, and returned to the patient.

Adverse Events: any negative outcomes in a clinical trial, whether they are causally related to the treatment or not.

Affinity: The strength of binding of one molecule to another at a single site, e.g. the binding of an antibody to an antigen.

Antibody: A protein that binds specifically to a particular substance—called its antigen. Each antibody molecule has a unique structure that enables it to bind specifically to its corresponding antigen, but all antibodies have the same overall structure and are known collectively as immunoglobulins. Antibodies are produced by differentiated B cells (plasma cells) in response to infection or immunization, and bind to and neutralize pathogens or prepare them for uptake and destruction by phagocytes.

Antigen presentation: The display of antigen on the surface of a cell in the form of peptide fragments bound to MHC (major histocompatibility complex) molecules. T cells recognize antigen when it is presented in this way.

Antigen: Any molecule that can bind specifically to an antibody or a T-cell receptor.

Antitoxin: An antibody to a bacterial toxin (historical term).

Apoptosis: A form of cell death common in the immune system, in which a cell activates its own internal death program. It is characterized by nuclear DNA degradation, nuclear degeneration and condensation, and the rapid phagocytosis of cell remains. Proliferating lymphocytes experience high rates of apoptosis during their development and during immune responses.

B cell lymphoma: A cancer of B cells; different cancers arise from different stages of B cell development.

B cell receptor: A receptor on the surface of B cells, specific for a particular antigen. It is composed of a transmembrane immunoglobulin molecule (which recognizes antigen). On activation by antigen, B cells differentiate into plasma cells producing antibody molecules of the same antigen specificity as this receptor.

B cell: One of the two types of antigen-specific lymphocytes responsible for adaptive immune responses, the other being the T cells. The function of B cells is to produce antibodies. B cells have highly diverse antigen receptors and are generated in the bone marrow throughout life, emerging to populate the blood and lymphoid tissues.

Binding: non-covalent close interaction of molecules

Biologics: Agents used as drugs that have a biological origin, such as antibodies or receptors.

Bispecific T cell Engagers: A type of antibody that can bind to two different antigens at the same time. Bispecific antibodies are being studied in the imaging and treatment of cancer. They are made in the laboratory.

bone marrow: The tissue where all the cellular elements of the blood—red blood cells, white blood cells, and platelets—are initially generated from hematopoietic stem cells. The bone marrow is also the site of further B-cell development in mammals and the source of stem cells that give rise to T cells on migration to the thymus. Thus, bone marrow transplantation can restore all the cellular elements of the blood, including the cells required for adaptive immune responses.

CD20: A surface marker on B cells; retained by B cell lymphoma cells.

CD28: a costimulatory receptor on T cells that receives signals from a danger-induced molecule on dendritic cells

CD3: A surface marker on T cells, part of the signaling complex of the TCR.

CD4: A surface marker on Helper T cells, a co-receptor with the TCR that binds to MHC on the antigen presenting cell.

CD8: A surface marker on Cytotoxic T cells, a co-receptor with the TCR that binds to MHC on the antigen presenting cell.

Cell-cycle arrest: Cell cycle arrest is a stopping point in the cell cycle, where it is no longer involved in the processes surrounding duplication and division.

Checkpoint Inhibitors: Approach to tumor therapy that attempts to interfere with the normal inhibitory signals that regulate lymphocytes

Chemokines: Small chemoattractant protein that stimulates the migration and activation of cells, especially phagocytic cells and lymphocytes. Chemokines have a central role in inflammatory responses.

Chimeric Antigen Receptor T cells: Similar to adoptive transfer of T cells, but the TCR is replaced by an engineered antibody and signaling molecules.

ciliated cells: Cells with tiny hair-like projections that sweep substances.

Clonal selection: The process by which one of the many T cells or B cells is activated and then proliferates.

Co-stimulatory molecules: Cell-surface proteins on antigen-presenting cells that deliver co-stimulatory signals to naive T cells. Examples are the B7/CD80/CD86 molecules on dendritic cells, which bind to CD28 on naive T cells.

CTLA-4 (Cytotoxic T Lymphocyte Associated protein-4): A high-affinity inhibitory receptor on T cells for B7 molecules on antigen presenting cells; its binding inhibits T-cell activation.

CTLA-4: cytotoxic T lymphocyte associated protein-4, a receptor on T cells that conveys a negative signal

Cytokines: Proteins made by a cell that affect the behavior of other cells, particularly immune cells. Cytokines made by lymphocytes are often called interleukins (abbreviated IL). Chemokines are a type of cytokine.

Cytotoxic T cell: A CD8+ T cell that is capable of killing infected or altered cells that display a particular antigen.

dendritic cells: Bone marrow-derived cells found in most tissues, including lymphoid tissues. There are two main functional subsets. Conventional dendritic cells take up antigen in peripheral tissues, are activated by contact with pathogens, and travel to the peripheral

lymphoid organs, where they are the most potent stimulators of T-cell responses. Plasmacytoid dendritic cells can also take up and present antigen, but their main function in an infection is to produce large amounts of the antiviral interferons as a result of pathogen recognition through receptors.

Effector function: how a cell accomplishes its job

effector mechanisms: Those processes by which pathogens are destroyed and cleared from the body. Innate and adaptive immune responses use most of the same effector mechanisms to eliminate pathogens.

EGFR: epidermal growth factor receptor, a surface protein targeted by a monoclonal antibody

Endotoxin: Toxins derived from bacterial cell walls released by damaged cells. They can potentially induce cytokine synthesis and in large amounts can cause a systemic reaction called septic shock or endotoxic shock.

Erysipelas: Bacterial infection (*Streptococcus pyogenes*) of skin causing “red skin”.

Fc Region of antibody: Constant region of an antibody.

Granzyme B: An enzyme secreted by cytotoxic T cells that causes apoptosis (death) of target cells.

Helper T cell: A CD4+ T cell that helps macrophages, helps B cells make antibodies, or helps cytotoxic T cells develop.

Hematocrit: Percent of blood volume occupied by red blood cells.

hematopoietic stem cells: Type of cell in the bone marrow that can give rise to all the different blood cell types.

HER2: human epidermal growth factor receptor 2, a surface protein targeted by a monoclonal antibody

Hormone: A chemical released into the blood to communicate with other cells.

Humanized antibody: an antibody that has a sequence characteristic of a human antibody except for the antigen recognition region

Humoral: Referring to effector proteins in the blood or body fluids, such as antibodies in adaptive immunity, or complement proteins in innate immunity/cellular

IL-1: A cytokine produced by active macrophages that has many effects in the immune response, including the activation of vascular endothelium, activation of lymphocytes, and the induction of fever.

IL-12: An activating interleukin for T cells.

IL-2: interleukin 2, a growth factor secreted by T cells that is critical for proliferation of T cells

Immunosuppression: Cells and molecules that inhibit an effective immune response.

innate immunity: The various innate resistance mechanisms that are encountered first by a pathogen, before adaptive immunity is induced, such as anatomical barriers, antimicrobial peptides, the complement system, and macrophages and neutrophils carrying nonspecific pathogen-recognition receptors. Innate immunity is present in all individuals at all times, does not increase with repeated exposure to a given pathogen, and discriminates between groups of similar pathogens, rather than responding to a particular pathogen.

Interferons: Several related families of cytokines originally named for their interference of viral replication.

Keytruda: (pembrolizumab) An anti-PD-1 monoclonal antibody, a checkpoint inhibitor, used to promote a T cell anti-tumor response.

leukocytes/white blood cells: A white blood cell. Leukocytes include lymphocytes, polymorphonuclear leukocytes, and monocytes.

lymph nodes: A type of peripheral lymphoid organ present in many locations throughout the body where lymphatic vessels converge.

Lymph: The extracellular fluid that accumulates in tissues and is drained by lymphatic vessels that carry it through the lymphatic system to the thoracic duct, which returns it to the blood.

lymphatic system: The system of lymph-carrying vessels and peripheral lymphoid tissues through which extracellular fluid from tissues passes before it is returned to the blood via the thoracic duct.

Lymphocyte: A class of white blood cells that bear variable cell-surface receptors for antigen and are responsible for adaptive immune responses. There are two main types—B lymphocytes (B cells) and T lymphocytes (T cells)—which mediate humoral and cell-mediated immunity, respectively.

Macrophage: Large mononuclear phagocytic cells present in most tissues that have many functions, such as scavenger cells, pathogen-recognition cells, production of pro-inflammatory cytokines. Macrophages arise both embryonically and from bone marrow precursors throughout life.

Mast cells: A large granule-rich cell found in connective tissues throughout the body, most abundantly in the submucosal tissues and the dermis. The granules store bioactive molecules including the vasoactive amine histamine, which are released on mast-cell activation. Mast cells are thought to be involved in defenses against parasites and they have a crucial role in allergic reactions.

Median Survival Time: the time it takes for half of patients in a clinical trial to die

MHC: Major Histocompatibility Complex, a protein that binds peptides and presents them to T cells.

Micron: A unit of distance, 1 millionth of a meter.

Monoclonal antibody (mab): an antibody derived from a clone of B cells, so that all of the antibody molecules are the same

Monocyte: Type of white blood cell with a bean-shaped nucleus; it is a precursor of tissue macrophages.

Mucus: Sticky solution of proteins (mucins) secreted by goblet cells of internal epithelia, forming a protective layer on the epithelial surface.

Mutation: A change in the gene sequence of a cell that often results in a change in the encoded protein sequence, that can change the function of the protein

Nanometer: A unit of distance, 1 billionth of a meter, 1 thousandth of a micron.

Neoantigen: an antigen generated by a cancer cell that is not found in normal cells

Neurotransmitter: A chemical messenger between neurons.

neutrophil/polymorphonuclear cell: The most numerous type of white blood cell in human peripheral blood. Neutrophils are phagocytic cells with a multilobed nucleus and granules that stain with neutral stains. They enter infected tissues and engulf and kill extracellular pathogens.

Objective Response Rate: the percentage of patients in a clinical trial who have a measurable reduction in tumor size

PD-1: Programmed death-1, a receptor on T cells that when bound by its ligands, PD-L1 and PD-L2, inhibits signaling from the antigen receptor. Target of cancer therapies aimed at stimulating T-cell responses to tumors.

Peptide: A short chain of amino acids, often derived from a larger protein.

Perforin: the protein secreted by cytotoxic T cells that makes a hole in targeted cells.

phagocyte/phagocytosis: The internalization of particulate matter by cells by a process of engulfment, in which the cell membrane surrounds the material, eventually forming an intracellular vesicle (phagosome) containing the ingested material.

Provenge: An FDA approved dendritic cell vaccine for prostate cancer that targets prostatic acid phosphatase.

Receptor: A protein molecule that recognizes (binds to) another molecule and transmits a signal.

Recognition: Specific binding of one molecule to another molecule

recombination activating genes (rag): A pair of genes whose protein products prompt rearrangement of part of the genes of B cells and T cells to allow generation of a large variety of antibodies and T cell receptors.

red blood cells: Non-nucleated cells in the blood that carry oxygen.

Regulatory T cells Tregs: CD4 T cells that inhibit T-cell responses and are involved in controlling immune reactions and preventing autoimmunity.

Repertoire: The diverse collection of antibodies and T cell receptors that recognize a broad range of antigens.

Rituximab: A monoclonal antibody that binds to CD20.

Sarcoma: A metastatic cancer of connective tissue or other non-epithelial tissue.

Serum: The liquid part of blood containing proteins and nutrients; can be separated from cells by centrifugation.

Somatic recombination: Rearrangement of nucleotides in DNA that results in the transcription and translation of diverse antibodies and TCRs.

Spleen: An organ in the upper left side of the peritoneal cavity containing a red pulp, involved in removing senescent blood cells, and a white pulp of lymphoid cells that respond to antigens delivered to the spleen by the blood.

T cell receptor (TCR): The cell-surface receptor for antigen on T lymphocytes.

T cell: One of the two types of antigen-specific lymphocytes responsible for adaptive immune responses, the other being the B cells. T cells are responsible for the cell-mediated adaptive immune reactions. They originate in the bone marrow but undergo most of their development in the thymus. The highly variable antigen receptor on T cells is called the T-cell receptor. Effector T cells perform a variety of functions in an immune response, acting always by interacting with another cell in an antigen-specific manner. Some T cells activate macrophages, some help B cells produce antibody, and some kill cells infected with viruses and other intracellular pathogens.

Th1: A subset of effector CD4 T cells characterized by the cytokines they produce. They are mainly involved in activating macrophages but can also help stimulate B cells to produce antibody

Th17: A subset of CD4 T cells that are characterized by production of the cytokine IL-17. They help recruit neutrophils to sites of infection

Th2: A subset of effector CD4 T cells that are characterized by the cytokines they produce. They are involved in stimulating B cells to produce antibody, and are often called helper CD4 T cells

Thymus: A central lymphoid organ, in which T cells develop, situated in the upper part of the middle of the chest, just behind the breastbone.

Tolerance: The failure to respond to an antigen. Tolerance to self antigens is an essential feature of the immune system; when tolerance is lost, the immune system can destroy self tissues, as happens in autoimmune disease.

Toll like receptors: Innate receptors on macrophages, dendritic cells, and some other cells, that recognize pathogens and their products, such as bacterial lipopolysaccharide. Recognition stimulates the receptor bearing cells to produce cytokines that help initiate immune responses

Tumor Microenvironment: Cells other than the cancer cells that make up the community of the tumor, including innate immune cells that promote tumor growth, the blood supply, the extracellular matrix, cytokines and growth factors, often immunosuppressive.

Type I interferons: Several related families of cytokines originally named for their interference of viral replication.

Vaccination: The deliberate induction of adaptive immunity to a pathogen by injecting a dead or attenuated (nonpathogenic) live form of the pathogen or its antigens (a vaccine). More generally applied, can be nucleic acids (DNA or RNA) that encode the antigen, or loading of dendritic cells ex vivo. Active vs passive Vaccination: Active vaccination causes B cells to secrete antibody or T cells to become activated; passive vaccination delivers pre-made antibody or antiserum that provides transient protection. Prophylactic vs therapeutic Vaccination: Prophylactic vaccination creates protection before the actual pathogen arrives; therapeutic vaccination attempts to thwart an ongoing illness or existing tumor.

Variable region of antibodies and TCRs: A part of the antibody protein that varies in each B cell; similar region of TCRs. The gene sequence of that region is rearranged during development to encode different amino acid sequences, resulting in binding to different antigens.

Yervoy: (ipilimumab) An anti-CTLA-4 monoclonal antibody, a checkpoint inhibitor, used to promote a T cell anti-tumor response.