

PCMI 2005 Tumor Modeling Course: Glossary

Compiled by Angela Gallegos

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A

adenocarcinoma: a malignant tumor of epithelial cells in a glandular pattern.

adjuvant: a pharmacological agent added to a drug to increase or aid its effect; an immunological agent that increases antigenic response.

aFGF: acidic fibroblast growth factor, a member of the family of fibroblast growth factors that promotes growth of epithelial cells, has angiogenic potential, and can be produced by tumor cells.

agglutination: the clumping together of red blood cells or bacteria, usually in response to a particular antibody.

AIDS: (*acquired immune deficiency syndrome*) a disease caused by the human immunodeficiency virus; it becomes evident when most of the patient's CD4+ T lymphocytes are lost, with the result that opportunistic pathogens are able to establish life threatening diseases.

allogeneic: (also *allogenic*) relating to a different species or race; being genetically different although belonging to or obtained from the same species, as in tissue grafts.

anaplastic: of or characterized by cells that have become less differentiated.

anastomosis: a naturally or surgically created, direct or indirect junction between two blood vessels or other tubular structures.

anatomical sequestration: immunological isolation caused by physiological barriers to antigens and lymphocytes and resulting in the non-rejection of foreign tissues; sites isolated in this way are called *immunologically privileged sites*.

angiogenesis: development of blood vessels stimulated by endothelial cell growth factors.

angiostatin: a factor that inhibits angiogenesis by preventing the proliferation of epithelial cells.

anoxia: a state of no oxygen that creates major tissue distress.

antibody: a protein substance produced in the blood or tissues in response to a specific antigen, such as bacterium or toxin, that destroys or weakens bacteria and neutralizes organic poisons, thus forming the basis of immunity; an immunoglobulin present in the

blood serum or body fluids as a result of antigenic stimulus and interacting only with the antigen that induced it or with an antigen closely related to it.

antigen: a substance that when introduced into the body stimulates the production of an antibody; antigens include toxins, bacteria, foreign blood cells, and the cells of transplanted organs.

anti-idiotypic: an antibody that treats another antibody as an antigen and suppresses its immunoreactivity.

anti-idiotypic antigen: an antibody directed against the antigen-specific part of the sequence of antibody or T cell receptor and thus recognizes the binding sites of other antibodies; in principle an anti-idiotypic antibody should inhibit a specific immune response and they are important to the regulation of the immune system.

antiserum: the fluid of clotted blood from an immune individual; antisera (pl.) contain heterogeneous collections of antibodies that bind the antigen used for immunization; the heterogeneity makes each antiserum unique.

autocrine: of, relating to, promoted by, or being a substance secreted by a cell and acting on surface receptors of the same cell.

autoimmunity: a condition in which substances naturally present in the body are treated as antigens, resulting in abnormal immune response and damage to the body's own tissues.

autologous: of, or relating to a natural, normal occurrence in a certain type of tissue or in a specific structure of the body; of or relating to a graft in which the donor and recipient areas are in the same individual.

avascular growth phase: the initial growth phase of a tumor, prior to its vascularization.

B

B cell: a type of white blood cell; many B-cells mature into plasma cells which can produce antibody proteins necessary to fight off infections; one of the two major classes of lymphocytes.

benign: referring to a tumor containing cells that closely resemble normal cells.

C

cancer: defective gene regulation of cell proliferation resulting in the uncontrolled multiplication of one or more clones; the defect usually arises in a single cell which then gives rise to a clone of actively proliferating daughter cells.

capillary sprouts: the first signs of angiogenesis.

caspase: any of a group of proteases that mediate apoptosis.

catalyst: a substance, usually used in small amounts relative to the reactants, that modifies and increases the rate of reaction without being consumed in the process.

CD3: a polypeptide complex composed of five chains($\gamma, \delta, \varepsilon, \zeta, \eta$) and associated with the T-cell receptor and functions in signal transduction.

CD4: a lymphocyte molecule found on the T lymphocytes (usually T helper cells) that recognizes antigenic peptides associated with a class II glycoprotein of the major histocompatibility complex.

CD8: a lymphocytes molecule found on the T lymphocytes (usually cytotoxic T cells) that recognizes antigenic peptides associated with a class I glycoprotein of the major histocompatibility complex.

cell cycle: the ordered sequence of events whereby a cell reproduces itself by duplicating its contents and dividing in two.

cell differentiation: the process by which a cell acquires a clearly specialized function or character, usually involving changes in gene expression.

cell maturation: the stage following cell division and prior to differentiation during which the organelles of a cell, i.e. its specialized components, grow and make it ready to perform the operations peculiar to its type.

cell-mediated immunity: see *cellular immunity*.

cellular immunity: Immunity resulting from a cell-mediated immune response. Also called *cell-mediated immunity*.

chemokines: small cytokines involved in the migration and activation of cells, especially macrophages and lymphocytes; they play a central part in inflammatory responses.

chemotactic stimulus: any substance that induces chemotaxis.

chemotaxis: motile response of a cell or organism that carries it towards (positive chemotaxis) or away from (negative chemotaxis) a chemical substance.

chemotherapy: the use of drugs that inhibit cell proliferation in the treatment of usually malignant diseases or infections.

chimeric: relating to a chimera; of different parts of origin.

chronic myelogenous leukemia: myelogenous leukemia marked by an abnormal increase in mature and immature granulocytes (as neutrophils, eosinophils, and myelocytes) especially in the bone marrow and blood that is characterized by fatigue, weakness, loss of appetite, spleen and liver enlargement, anemia, thrombocytopenia, and ultimately a dangerous increase in blast cells (especially myeloblasts and lymphoblasts) that occurs especially in adults and that is associated with the presence of the Philadelphia chromosome.

class I antigens: cell membrane bound glycoproteins that are coded by genes of the *MHC*.

class II antigens: cell membrane glycoprotein encoded by genes of the *MHC*; these antigens are distributed on antigen-presenting cells such as macrophages, B cells, and dendritic cells.

clone: a population of identical cells or DNA molecules descended from a single progenitor.

collagen: a triple-helical protein that forms fibrils of great tensile strength; a major component of the extracellular matrix and connective tissues.

collagenase: an enzyme that catalyzes the cleavage of peptide bonds into triple-helical collagen.

complement: a group of proteins found in normal blood serum and plasma that are activated sequentially in a cascade-like mechanism that allows them to combine with antibodies and destroy pathogenic bacteria and other foreign cells.

concomitant resistance: resistance to a second tumor challenge conferred by a growing tumor.

cytokine: any of several regulatory proteins, such as the interleukins and lymphokines, that are released by cells of the immune system and act as intercellular mediators in the generation of the immune response.

cytoplasm: viscous contents of a cell contained within the plasma membrane outside its nucleus; the part of the cytoplasm not contained within any cell component is called the *cytosol*.

cytotoxic: of, relating to, or producing a toxic effect on cells.

cytotoxic T cell: subset of T lymphocytes (mostly CD8) responsible for lysing target cells and for killing virus infected cells (in the context of Class I histocompatibility antigens).

D

dendritic cell: any of various antigen-presenting cells with long irregular processes.

diploid: containing two sets of homologous chromosomes and hence two copies of each gene or locus.

dormancy: In a condition of biological rest or inactivity characterized by cessation of growth or development and the suspension of many biological processes. With respect to tumors, *tumor dormancy*, we mean the disappearance and reappearance of tumors.

E

effector cell: any cell capable of mediating an immune function without the need for further differentiation.

endocrine: adjective used of a hormone produced by a gland or cell and secreted into the bloodstream to act on distant cells or tissues.

endogenous: originating or produced within an organism, tissue or cell (*endogenous secretions*); caused by factors within the body.

endothelial cells: flat cells that line the blood vessels and regulate exchanges between the bloodstream and surrounding tissues.

enzymes: proteins that catalyze a specific chemical reaction.

epitope: (also *antigenic determinant*) a site on an antigen that is recognized and bound by a particular antibody or T cell receptor.

erythema: redness of the skin caused by dilatation and congestion of the capillaries, often a sign of inflammation or infection.

ex vivo: *in vitro*, in an artificial environment outside the living organism.

exogenous: derived or developed from outside the body; originating externally.

exophytic masses: a noninvasive neoplasm projecting from an epithelium.

F

fibroblast: common cell type found in connective tissues, secretes an extracellular matrix rich in collagen and other macromolecules; it migrates and proliferates readily in damaged tissues and in tissue cultures.

fibrosis: an abnormal amount of fibrous tissue in an organ due to proliferation of interstitial connective tissue stimulated by a previous or ongoing disease.

G

ganglioside: any of a group of galactose-containing cerebrosides found in the surface membranes of nerve cells.

growth factor: an extracellular polypeptide molecule that binds to a cell-surface receptor and triggers a signal-transduction pathway that leads to cell proliferation or cell differentiation.

H

hairy cell leukemia: a rare form of leukemia, usually originating with B cells, characterized by cells with cilia-like projections that proliferate in the bone marrow, spleen and liver.

haptotaxis: orientation movement in response to a stimulus provided by contact with a solid body.

helper cell: a subset of T-lymphocytes that acts in cooperation with B lymphocytes to produce antibody formation.

hematologic: of, or relating to, or involved in hematology.

hematology: the science encompassing the medical study of the blood and the blood producing organs.

histocompatibility: term used in immunology to describe the genetic system that codes cell surface differences leading to the rejection of tissue and organ grafts.

humoral immunity: The component of the immune system involving antibodies that are secreted by B cells and circulate as soluble proteins in blood plasma and lymph.

hybridoma: a cell hybrid in which a tumor cell forms one of the original source cells.

hypotension: abnormally low blood pressure.

hypoxia: oxygen deficiency.

I

idiotype: a determinant that confers on an immunoglobulin molecule an antigenic individuality that is analogous to the individuality of the molecule's antibody activity.

immunogenic: capable of producing an immune response.

immunogenicity: the quality or state of being *immunogenic*.

immunoglobulin: Any of a group of large glycoproteins that are secreted by plasma cells and that function as antibodies in the immune response by binding with specific antigens. There are five classes of immunoglobulins: IgA, IgD, IgE, IgG, IgM.

immunomodulation: therapeutic alteration of the activity of the immune system with drugs or biological components to either boost a useful response (*immunostimulation*) or suppress a counter-productive response (*immunosuppression*).

immunosuppression: (also *immunodepression*) suppression of the immune response, as by drugs or radiation, in order to prevent the rejection of grafts or transplants or control autoimmune diseases.

immunotherapy: Treatment of disease by inducing, enhancing, or suppressing immune response.

in situ: in the original position; confined to the site of origin.

in vitro: in an artificial environment outside a living organism.

inducer cell: cells that induce other nearby cells to differentiate in specified pathways.

induration: the hardening of a normally soft tissue or organ, especially the skin, because of inflammation, infiltration of a neoplasm, or an accumulation of blood; a focus or region of abnormally hardened tissue.

inhibitors: natural or synthetic substances capable of stopping or slowing down a particular biological process.

interferon: any of a group of heat-stable soluble basic antiviral glycoproteins of low molecular weight that are produced usually by cells exposed to the action of a virus, sometimes to the action of another intracellular parasite (as a bacterium), or experimentally to the action of some chemicals, and that include some used medically as antiviral or antineoplastic agents.

interleukin: generic term for cytokines produced by leukocytes; they primarily affect

the growth and differentiation of hematopoietic (literally “blood making”) and immune-system cells.

intradermal: within or between the layers of the skin.

intralymphatic: situated within or introduced into a lymphatic vessel.

K

kaposi’s sarcoma: a cancer characterized by numerous bluish-red nodules on the skin, usually on lower extremities, that is endemic to equatorial Africa and occurs in a particularly virulent form in people with AIDS.

killer cell: mammalian cells which can lyse antibody coated target cells; they have a receptor for the Fc portion of IgG and are probably of the mononuclear phagocyte lineage, though some may be lymphocytes. (Not to be confused with cytotoxic T-cells which recognize targets by other means and are a subset of T lymphocytes.) 2. Natural killer cell are CD3 negative large granular lymphocytes, mediating cytolytic reactions that do not require expression of Class I or II major histocompatibility antigens on the target cell. 3. Lymphokine activated killer cells are NK cells activated by interleukin-2 (LAK cells).

L

langerhans cell: any of the dendritic cells of the interstitial spaces of the mammalian epidermis that appear rod- or racket-shaped and are similar to melanocytes but cannot oxidize phenols.

leukemia: any of various acute or chronic neoplastic diseases of the bone marrow in which unrestrained proliferation of white blood cells occurs and which is usually accompanied by anemia, impaired blood clotting, and enlargement of the lymph nodes, liver, and spleen.

ligand: any molecule recognized by a receptor.

locus: the place occupied by one or more genes on a specific chromosome.

lumen: cavity enclosed by an epithelial sheet (in a tissue) or by a membrane (in a cell); usually refers to the space inside a tube (artery, vein, intestine).

lymphocytes: any of the nearly colorless cells found in the blood, lymph, and lymphoid tissues, constituting approximately 25% of white blood cells and including B cells, which function in humoral immunity, and T cells, which function in cellular immunity.

lymphokine: any of various substances released by T cells that have been activated by antigens; they function in the immune response through a variety of actions, including stimulating production of non-sensitized lymphocytes and activating macrophages.

lymphoma: any of various, usually malignant tumors arising in the lymph nodes or lymphoid tissue.

lysis: decomposition; dissolving; disintegration; hydrolysis.

M

macrophage: a phagocytic tissue cell of the mononuclear phagocyte system that may be fixed or freely motile, is derived from a monocyte, and functions in the protection of the body against infection and noxious substances.

malignant: threatening to life, as a disease, virulent; tending to metastasize, cancerous.

melanocytes: cells that produce melanin, the pigment that gives a brown to black color to the skin and hair.

melanoma: a dark pigmented, usually malignant tumor arising from a melanocyte and occurring most commonly in the skin.

metabolism: the sum of chemical changes that occur in living cells.

metabolites: generic term used for any of the intermediate, end, or waste products of metabolism.

metastases: cancer that started from cancer cells from another part of the body.

metastasis: the transfer of tumor cells from a primary malignant tumor to a secondary site.

methotrexate: used in chemotherapy; a dihydrofolate analog, inhibitor of eukaryotic dihydrofolate reductase.

MHC: (*major histocompatibility complex*) a group of genes that code for cell surface histocompatibility antigens and are the principle determinants of tissue type and transplant compatibility.

mitomycin C: inhibitor of DNA synthesis and nuclear division.

mitotic: adjective referring to mitosis, i.e. the normal division of the nucleus during the cell cycle that results in the condensation of DNA into visible chromosomes.

monoclonal: of, forming, or derived from a single clone.

murine: pertaining to mice.

myeloma: malignant tumor formed by cells of the bone marrow.

N

natural killer (NK) cell: large granular lymphocytes which do not express markers of either T or B-cell lineage; these cells do possess Fc receptors for IgG and can kill target cells using antibody-dependent cell-mediated cytotoxicity; NK cells can also use perforin to kill cells in the absence of antibody; Killing may occur without previous sensitization.

necrosis: morphologic changes associated with the death of cells due to chemical or physical injury; it results in extensive debris that must be removed by phagocytosis.

neoantigen: (a.k.a. *tumor antigen*, *T antigen*) any of several antigens present on tumors induced by certain types of adenovirus and popovaviruses or in cells transformed in vitro by these viruses.

neoplasia: uncontrolled cell proliferation; formation of a neoplasm.

neoplasm: new and abnormal growth of tissue, which may be benign or cancerous; synonym for cancer.

neoplastic: pertaining to or like a neoplasm with new and abnormal growth, pertaining to neoplasia with the formation of a neoplasm.

neovascularization: formation of new vessels in response to a stimulus, such as the secretion of angiogenic factors.

O

oncogenic: tending to cause or give rise to tumors.

opsonization: a process whereby opsonins make an invading microorganism more susceptible to phagocytosis.

P

palliative: relieving or soothing the symptoms of a disease or disorder without effecting a cure.

pancytopenia: a pronounced reduction in all elements of the blood.

paracrine: of, relating to, promoted by, or being a substance secreted by a cell and acting on adjacent cells.

pathogen: an agent that causes disease, especially a living microorganism such as a bacterium or fungus.

phenotype: the observable character conferred on a cell or organism by the expression of a particular gene.

plasma cell: a terminally differentiated antibody forming and usually antibody secreting cell of B-cell lineage.

polymerase: any of various enzymes that catalyze polymerization, especially those that catalyze the synthesis of polynucleotides of DNA or RNA using an existing strand of DNA or RNA as a template.

precipitation: the process of separating a substance from a solution as a solid.

prevascular growth: same as avascular growth phase.

proliferating rim: rim rich in cells during proliferation.

promotor: DNA sequence to which RNA polymerase binds to begin transcription, i.e. the transfer of genetic information.

R

radiation therapy: (*radiotherapy*) the use of x-rays, gamma rays, protons, ions, and other forms of radiation to treat tumors and diseases.

reagent: a substance used in a chemical reaction to detect, measure, examine, or produce other substances.

receptor: cell-surface molecule that binds a specific extracellular signaling molecule and initiates a response in the cell.

resection: surgical removal of all or part of an organ, tissue or structure.

S

sarcoma: a malignant tumor arising from connective tissues.

sepsis: the presence of pathogenic organisms or their toxins in the blood or tissues; the poisoned condition resulting from the presence of pathogens or their toxins, as in *septicemia*.

septic shock: shock associated with *sepsis*, usually associated with abdominal and pelvic infection resulting from trauma or surgery; shock associated with *septicemia* caused by gram-bacteria.

signal-transduction pathway: a series of intracellular events triggered by binding of a signaling molecule to a receptor that convert an extracellular signal into a cellular response.

stem cell: an unspecialized cell that gives rise to a specific specialized cell, such as a blood cell.

subcutaneous: located, found or placed just beneath the skin; hypodermic.

suppressor cell: a cell of the immune system that inhibits or helps to terminate an immune response, e.g. suppressor macrophages and suppressor T cells.

T

T cell: (also *T lymphocyte*) a class of lymphocytes, so called because they are derived from the thymus and have been through thymic processing. Involved primarily in controlling cell-mediated immune reactions and in the control of B-cell development; the T-cells coordinate the immune system by secreting lymphokine hormones; there are 3 fundamentally different types of t cells : helper, killer, and suppressor; each has many subdivisions.

T cell receptor: antigen binding molecule expressed on the surface of T cells and associated with CD3.

transfection: infection of a cell with isolated viral nucleic acid, followed by production of the complete virus in the cell; also the incorporation of exogenous DNA into the cell.

tumor necrosis factor: originally described as a tumor inhibiting factor in the blood of animals exposed to bacterial lipopolysaccharide or Bacille Calmette-Guerin; preferentially kills tumor cells in vivo and in vitro, causes necrosis of certain transplanted tumors in mice and inhibits experimental metastases; usually considered a *cytokine*.

V

vaccine: A preparation of weakened or killed pathogen, such as bacterium or virus, or of the pathogen's structure that upon administration stimulates antibody production or cellular immunity against the pathogen but is incapable of causing severe infection.

vascular growth phase: an advanced stage in the growth of a tumor, when its survival depends on the oxygen and nourishment provided by its newly formed blood vessels.

vitiligo: a skin disorder manifested by smooth white spots on various parts of the body.

X

xenograft: a graft transplanted from a donor of one species to a host of another species.

Definitions taken from:

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CancerWEB's online medical dictionary

Adam, J. and Bellomo, N. *A survey of models for tumor-immune system dynamics*.
Birkhauser Boston, 1997.