



UNIT THREE TEACHER GLOSSARY

Adherens junctions - appear as bands encircling the cell (zonula adherens) or as spots of attachment to the extracellular matrix (adhesion plaques). Cadherin “hooks” fit together on the outside of the plasma membranes with the catenin portions entering inside on the cytoplasmic face, attaching to the actin cytoskeleton.

Apoptosis - programmed cell death

Blastocyst - 5-14 day old embryo; the structure formed after the morula; it consists of about 100 cells, with pluripotent stem cells located in the inner cell mass

Cadherins - hook-like proteins on the plasma membranes of cells that serve to link cells together as part of an adherens junction.

Cancer stem cell - a mutated stem cell, found in tumors, which can differentiate into all cells in a tumor

Cancer stem cell hypothesis – a hypothesis that states some cancers are initiated and propagated by cancer stem cells, or stem cells that have been mutated or subjected to an abnormal microenvironment

Catenins – the cytoplasmic portion of an adherens junction; these proteins (complexed with cadherins) bind the actin cytoskeleton to secure cells.

Clonal evolution model - a cell (clone) with a mutation in a tumor suppressor gene or oncogene will expand only if that mutation gives the clone a competitive advantage over the other clones and normal cells in its microenvironment. Thus, the process of carcinogenesis is a process of Darwinian evolution, known as somatic or clonal evolution.

Common myeloid progenitor - cells which give rise to “megakaryocyte/erythrocyte [Red Blood Cell] or granulocyte/macrophage [White Blood Cell] progenitors”, which will later give rise to RBC’s or White Blood Cells

(<http://www.ncbi.nlm.nih.gov/pubmed/10724173>)

Contact inhibition - the natural process of arresting cell growth when two or more cells come into contact with each other. This property is used to distinguish between normal and cancerous cells.

Cyclin-dependent kinases - protein kinases that control cell cycle progression in all eukaryotes and require physical association with cyclins to achieve full enzymatic activity.

Desmosomes - a cell structure specialized for cell-to-cell adhesion; localized in patches randomly arranged on the sides of plasma membranes; help to resist shearing forces; bind muscle cells to one another.

Differentiate - the transformation of an unspecific cell to a cell with a specified role in the microenvironment.

Dimer - a chemical or biological entity consisting of two structurally similar subunits called monomers, which are joined by non-covalent bonds, which can be strong or weak.



Downregulation - the process by which a cell decreases the quantity of RNA or protein in response to a signal.

Embryonal carcinoma cell – a type of cancer cell which has the ability to switch fates with embryonic stem cells (and vice versa) depending on the microenvironment and genetic reprogramming.

Enzymes - proteins that catalyze (increase the rates of) chemical reactions. In enzymatic reactions, the molecules at the beginning of the process are called substrates, and the enzyme converts them into different molecules, called the products.

Exon - a nucleic acid sequence that is represented in the mature form of an RNA molecule (messenger RNA) after non-coding RNA (intron) removal.

Factor - any ligand, transcription factor, chemical, or microenvironmental “thing” that elicits a reaction from the cell

Fibroblast - a cell found in connective tissue that produces fibers such as collagen

G0 – (pronounced G zero) pre-mitosis, resting state, or quiescence. Most cells are usually ‘standing by’ in this phase before signals cause them to undergo mitosis. A tissue stem cell exists in G0 until it is activated.

Gap junctions - directly connect the cytoplasm of two cells, which allows various molecules and ions to pass freely between cells.

Gene expression - the process by which DNA is transcribed into mRNA, then translated into protein.

Glial cell - Cells located in the CNS which offer support and insulation to neurons; they are the most abundant type of cell in the CNS, with three types: astrocytes, oligodendrocytes, and microglia

Hematopoietic (blood-forming) stem cell - a stem cell of the bone which gives rise to Red Blood Cells, other myeloid cells, and lymphoid cells

In vitro - performed in a test tube or culture, outside of a host organism

Integrin - receptors that mediate attachment between a cell and the tissues surrounding it, which may be other cells or the extracellular matrix; play a role in cell signaling thereby regulating the cell cycle and defining cellular shape and mobility.

Intron - a DNA region within a gene that is not translated into protein.

Ligands – a substance that binds to and forms a complex with a receptor or target protein; often triggers a signal from the cell.

Lysosome - vesicles filled with hydrolytic enzymes which are used to break down organic matter in the cell, or the cell itself if during apoptosis

Malignancy (malignant) - tumor causing cancer which is liable to spread to different parts of the body, opposite from benign

Metastasis - spread of cancer to other locations in the body via lymph or blood

Microenvironment – a cell’s interface with the outside world, which feeds into its behavior through gene expression; soluble factors, extracellular matrix molecules, cell-cell contacts, and forces are components of the microenvironment.



Oncogene - a mutated proto-oncogene, which normally codes for proteins promoting cell growth, mitosis, and differentiation. An oncogene is said to be activated when the gene mutates, producing an abnormal protein with dysfunctional activity; it takes several oncogenic mutations to cause the cell to grow uncontrolled into a tumor.

p21 – a cyclin-dependent kinase inhibitor gene; it encodes for the protein WAF1, which binds to and inhibits the activity of cyclin-dependent kinases, prevalent in G1 of the cell cycle. It is a cell cycle regulatory gene.

p53 - the “Guardian Angel” of the cell, this gene regulates the production of other proteins and the transcription factors needed to express other regulatory genes; it activates DNA repairing enzymes/proteins and apoptosis if the DNA cannot be repaired. One of its many functions is to prevent DNA damage--which causes mutations--from being passed on to progeny cells.

Point mutation – a single nucleotide mutation; can be in the form of a deletion or insertion

Proliferate - to grow into larger numbers, or multiply, by cell division

Proto-oncogene – a gene that normally codes for a protein regulating cell growth, mitosis, or differentiation, which when mutated, can lead to abnormal or overactive function and cancer. Once a proto-oncogene has been mutated, it is called an oncogene.

Quiescent - dormant, as in the G0 phase; describes a stem cell that still has basal metabolic activity but behaviorally it is staying still in one spot, not proliferating, not differentiating, simply surviving.

Sarcoma – cancerous growth of connective tissue; differs from carcinomas, which are cancers of the epithelium

SCID mice - Severe Combined Immunodeficiency, a condition which means that the immune system is unable to fight any disease or infection. SCID mice are used to observe the effects of viruses/bacteria/cancer causing factors, and medicines to fight said abnormalities

Signaling cascade - signal transduction refers to any process by which a cell converts one kind of signal or stimulus into another; most processes of signal transduction involve ordered sequences of biochemical reactions inside the cell, which are carried out by enzymes and second messengers, resulting in a *signal transduction pathway*. The number of proteins participating in signal transduction increases as the process emanates from the initial stimulus, resulting in a signaling cascade, beginning with a relatively small stimulus that elicits a large response. This is referred to as *amplification of the signal*.

Signaling factor – any molecule that elicits a signaling pathway or cascade.

Stem cell niche - the microenvironment in which stem cells are found that controls their behavior

Tight junctions - closely associated areas of two vertebrate cells, in which the membranes join to form a virtually impermeable barrier to fluid and ions.



Transcription factor - a type of protein which binds to a specific sequence on DNA and signals/aids RNA polymerase to start transcription

Translocation - the movement of DNA/ chromosomes from its original spot to another; this often results in deleterious mutations.

Tumor - a cancerous mass which contains a collection of cell types; some are terminally differentiated, some can proliferate and differentiate to some degree, and a significant number may be able to form all tumor cell types.

Tumor suppressor gene - normal genes that slow down cell division, repair DNA mistakes, and tell cells when to die. A mutated tumor suppressor gene leads to cancer because cells make an abnormal protein that doesn't correctly act to suppress cancerous attributes like rapid cell growth, survival, and metastasis.

Upregulation - the process by which a cell increases the quantity of RNA or protein in response to a signal.