Unit Two Student Glossary

Allogeneic - taken from different individuals of the same species. Two or more individuals are said to be allogeneic to one another when the genes at one or more loci are not identical.

Example: Bone marrow transplants, where adult hematopoietic stem cells are taken from the bone marrow of one individual and transplanted into another, are an example of allogeneic transplants. These transplanted cells will home in the recipient's bone marrow and replenish their blood cells.

Blastema - a mass of undifferentiated adult stem cells that in newts gives rise to a new limb through a process called regeneration. Aside from some amphibians and fish, most animals cannot produce blastemas.

Example: The newt forms a blastema at the site of injury that is composed of a mass of adult stem cells and progenitor cells that form a new limb. The adult stem cells in a blastema are formed through a process of dedifferentiation (when a cell becomes more primitive) of local adult tissue, a process that does not occur in vertebrates like us.

Cell fate - the ultimate differentiated state to which a cell has become committed.

Example: Erythrocytes (red blood cells) are at the end of their lineage and are fully committed to their cell fate. There is nothing more specialized that they can differentiate into in their lineage. Similarly lymphocytes (a type of white blood cells) are also at the end of their lineage and have fully committed to their cell fate.

Differentiate - the process by which a less specialized cell becomes a more specialized cell type

Example: In response to different extracellular factors mesenchymal stem cells can differentiate to form progenitors of cartilage cells, fat cells, muscle cells, and bone cells.

Epidermal stem cell - this stem cell replenishes skin, hair follicles, and sebaceous glands through the processes of asymmetric cell division and transient amplification

Example: Epidermal stem cells regenerate the outer layer of your skin by forming keratinocytes that migrate to the surface and form a protective layer. Through this system we can replenish this vital organ that protects us from UV light and damaging chemicals, and is vital in maintaining homeostasis. Epidermal stem cells also play a

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critical role in wound healing.

Hematopoietic stem cells - multipotent stem cells that give rise to all the blood cell types including myeloid (monocytes and macrophages, neutrophils, basophils, eosinophils, erythrocytes, megakaryocytes/platelets, dendritic cells), and lymphoid lineages (T-cells, B-cells, NK-cells).

Example: Hematopoietic stem cells replenish all of our blood cells. This includes red blood cells (erythrocytes), which transport oxygen throughout our bodies, yet circulate in our system for only 100 to 120 days. Without hematopoietic stem cells to replenish our supply we could not survive.

Homeostasis - the ability to regulate internal conditions, usually by a system of feedback controls, so as to stabilize health and proper function amidst outside changing conditions.

Example: Regeneration of damaged cells in the normal function of our tissues is critical to tissue homeostasis.

Multipotent – the ability of adult stem cells to differentiate into a number of cells, but only those of a closely related family of cells (a lineage).

Example: Neural stem cells can regenerate the brain's three main cell types (neurons, astrocytes, and oligodendrocytes). Hematopoietic stem cells can replenish all the body's blood cells. These two types of multipotent stem cells can each generate cells in their own lineage, but not in another. Neural stem cannot generate blood cells and visa versa. Neural stem cells, hematopoietic stem cells, mesenchymal stem cells, and epithelial stem cells are all examples of mulipotent stem cells.

Neurogenesis - is the process by which neurons are generated. Neurogenesis does indeed continue into and throughout adult life, specifically in the hippocampus and olfactory bulb of mammals.

Example: Neurons in our olfactory bulb, which help us distinguish smells, are often damaged due to direct exposure to air. Neural stem cells can regenerate these damaged neurons through neurogenesis.

Pluripotent - the ability of the human embryonic stem cell to differentiate along all lineages and become any cell type in the body. (They are only restricted from forming extra embryonic tissues, such as placenta and umbilical cord.)

Example: Embryonic stem cells (in contrast to adult stem cells) can differentiate to form cells of all three germ layers (many different lineages). They can generate blood cells, neurons, muscle cells, fat cells, etc…

Progenitor cells - is an early descendant of a stem cell that can only undergo differentiation, but not self- renewal. It is limited to differentiate along a specific cell lineage.

Example: A neural stem cells will give rise to a progenitor cell, which is already committed to differentiation and will give rise to a neuron.

Self-renew - the ability to go through numerous cycles of cell division while maintaining the undifferentiated state.

Example: To make sure of the quality of hematopoietic stem cells for bone marrow transplants it is important to make sure that the cells can not only repopulate the blood cells in a recipient, but also that bone marrow from that recipient can be transplanted to repopulate the blood of yet another recipient. This shows that cells are not only potent (can make all sorts of blood cells), but that they can self-renew and maintain their own population.

Specialized - referring to cells that perform specialized functions in multicellular organisms. Groups of specialized cells cooperate to form a tissue, such as a muscle.

Example: In your muscles specialized muscle cells contain filaments that slide past each other and change the cells' size, which leads to flexing of the muscle. These cells are restricted to their function. Photoreceptor cells in your eyes are specialized for a very different function of absorbing light and triggering a chain of biological processes that allow us to see.

Undifferentiated - describing a cell that has not yet acquired a specialized structure and function; pertaining to an immature cell or a primitive cell

Example: All stem cells are undifferentiated, in that they are fully specialized cells at the end of a lineage.

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