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## Apoptosis: a Review of Programmed Cell Death

Apoptosis is a form of cell death in which a programmed sequence of events leads to the elimination of cells without releasing harmful substances into the surrounding area. Apoptosis is ATP-dependent and is characterized by cell and organelle shrinkage, and membranes blebbing. Apoptosis plays a crucial role in developing and maintaining the health of the body by eliminating old cells, unnecessary cells, and unhealthy cells.

The human body replaces perhaps one million cells per second. When apoptosis does not work correctly, cells that should be eliminated may persist and become immortal, for example, in cancer and leukemia. When apoptosis works overly well as, it kills too many cells and inflicts grave tissue damage. This is the case in strokes and neurodegenerative disorders such as Alzheimer's, Huntington's, and Parkinson's disease.

Apoptosis is also known as a programmed cell death. Necrosis is ATP-independent and has its unique morphological characteristics such as increased cell or organelle volume (oncosis), Mitochondrial swelling, rupture of plasma membrane (cellular leakage and consequent inflammation). Necrosis is the name given to unprogrammed death of cells and living tissue. It is less orderly than apoptosis, which are part of programmed cell death. In contrast with apoptosis, cleanup of cell debris by phagocytes of the immune system is generally more difficult as the disorderly death generally does not send cell signals which tell nearby phagocyte to engulf the dying cell. This lack of signaling makes it harder for the immune system to locate and recycle dead cells which have died through necrosis than if the cell had undergone apoptosis. The release of intracellular content after membrane damage is the cause of inflammation in necrosis. There are many causes of necrosis including injury, infection, cancer, infarction, toxins and inflammation. Severe damage to one essential system in the cell leads to secondary damage to other systems, a so-called "cascade of effects".

Necrosis can arise from lack of proper care to a wound site. Necrosis is accompanied by the release of special enzymes that are stored by lysosomes, which are capable of digesting cell components or the entire cell itself. The injuries received by the cell may compromise the lysosome membrane, or may initiate an unorganized chain reaction which causes the release of enzymes. Unlike Apoptosis, cells that die by necrosis may release harmful chemicals that damage other cells.

Tissue detection of necrosis is usually defined in a negative fashion by excluding other types of cell death, such as apoptosis and autophagic cell death. Although semi-quantification of tissue

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necrosis is possible based on histology, its gross quantification remains the same.

I have seen the effects of necrosis and what it does to the tissue cells. The damage cell often dies, leaving horrible open decubitus ulcers that become difficult to heal. My brother was diagnosed with ESD (End Stage Renal Disease). He was hospitalized for months.

During his stay at the hospital, there was a breakdown with tissue cells which eventually caused an ulcer. This type of circumstance could have definitely been avoided, however it was not caught in time.

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