

Hypoxia results from:

1. Ischemia
2. Hypoxemia
3. Hemoglobin abnormalities (anemia, CO poisoning, methemoglobinemia)

Mechanisms of cell injury (headlines):

1. ATP depletion
2. Accumulation of Reactive Oxygen Species (ROS)
3. Influx of calcium
4. Increased permeability of cellular membranes
5. Mitochondrial damage
6. Accumulation of damaged DNA & misfolded proteins

Patterns of necrosis:

- 1) **Coagulative necrosis:** seen in ischemic necrosis of solid organs.
- 2) **Liquefactive necrosis:** seen in abscess of solid organs and brain infarcts
- 3) **Fat necrosis:** in fatty tissue. Note: calcium appears blue in light microscopy because it likes hematoxylin stain.
- 4) **Caseous necrosis:** it is highly characteristic of TB (tuberculosis), but not diagnostic. (90% in TB, 10% in rhinophyma [rosacea])
 - A *caseation* is a homogenous eosinophilic acellular material, usually found in the center of a granuloma.
 - Layers of a caseating granuloma from inside out:
 - a) Caseation: necrotic tissue [central].
 - b) 3-4 layers of epitheloid macrophages [activated macrophages with large amount of eosinophilic cytoplasm].
 - c) 2-3 layers of lymphocytes stimulating the macrophages by cytokines so that they become bigger and more capable of phagocytosis.
- 5) **Gangrenous necrosis:** coagulative or liquefactive necrosis of the limbs.

We have **two** types of irreversible cell injury: *apoptosis* and *necrosis*.

Councilman body: is an apoptotic liver cell seen during viral hepatitis.

Q// what is the difference between *apoptosis* and *necrosis*?

Apoptosis	Necrosis
1) It involves individual cells.	1) It involves a group of cells.
2) It is an active process (energy-requiring).	2) It is a passive process (no energy required).
3) It is a clean and regulated process in which the cell is broken down into apoptotic bodies that are removed by macrophages.	3) It is a messy process in which the cell is fragmented. It also disrupts the surrounding tissue.
4) There is no inflammatory reaction.	4) It causes an inflammatory reaction.
5) The cell size becomes smaller (shrinkage).	5) The cell size becomes bigger by hydropic swelling.
6) It is mostly a physiological process, sometimes it becomes pathological.	6) It is always a pathological process.

The author is not responsible for any mistakes or incorrect information herein.