

Pathology

Sheet

Slide



number

2

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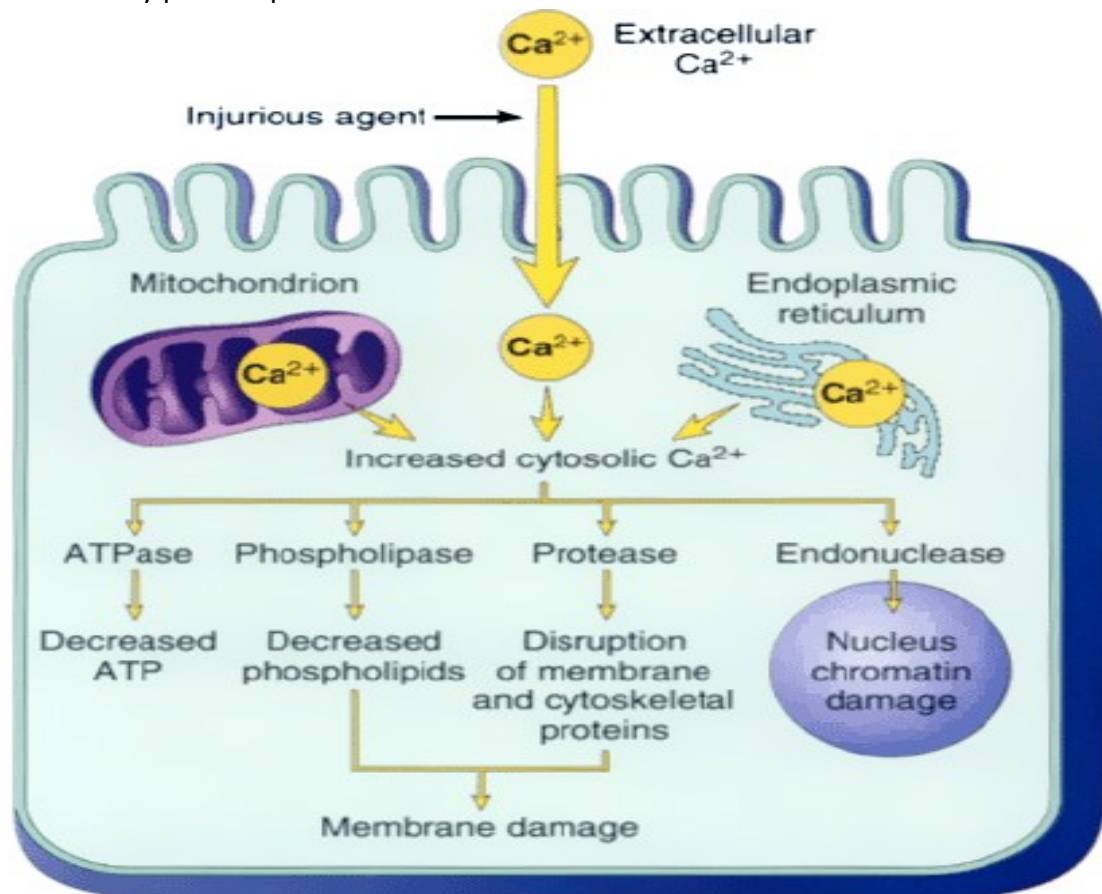
Marwan Qubaja

Losing membrane integrity (cell membrane damage) will affect many things, most commonly the sodium potassium pump. Influx of Na will cause cellular swelling (Na is more outside the cell) of all membrane bound organelles for example the swelling of the RER, during which ribosomes will detach affecting protein synthesis.

Decrease of oxygen (Ischemia), leads to decreased ATP synthesis, the cell tries to compensate by performing anaerobic glycolysis, the glycogen stored as source of energy will be decreased, also lactic acid will be produced during a.a which increases the acidity causing clumping of chromatin in the nucleus (affecting the proliferation\cell division).

Decrease of protein synthesis: occurs in two states:

1. Detachment of ribosomes
2. Large amount of Calcium inside the cell will activate many enzymes which degrade the already present proteins.

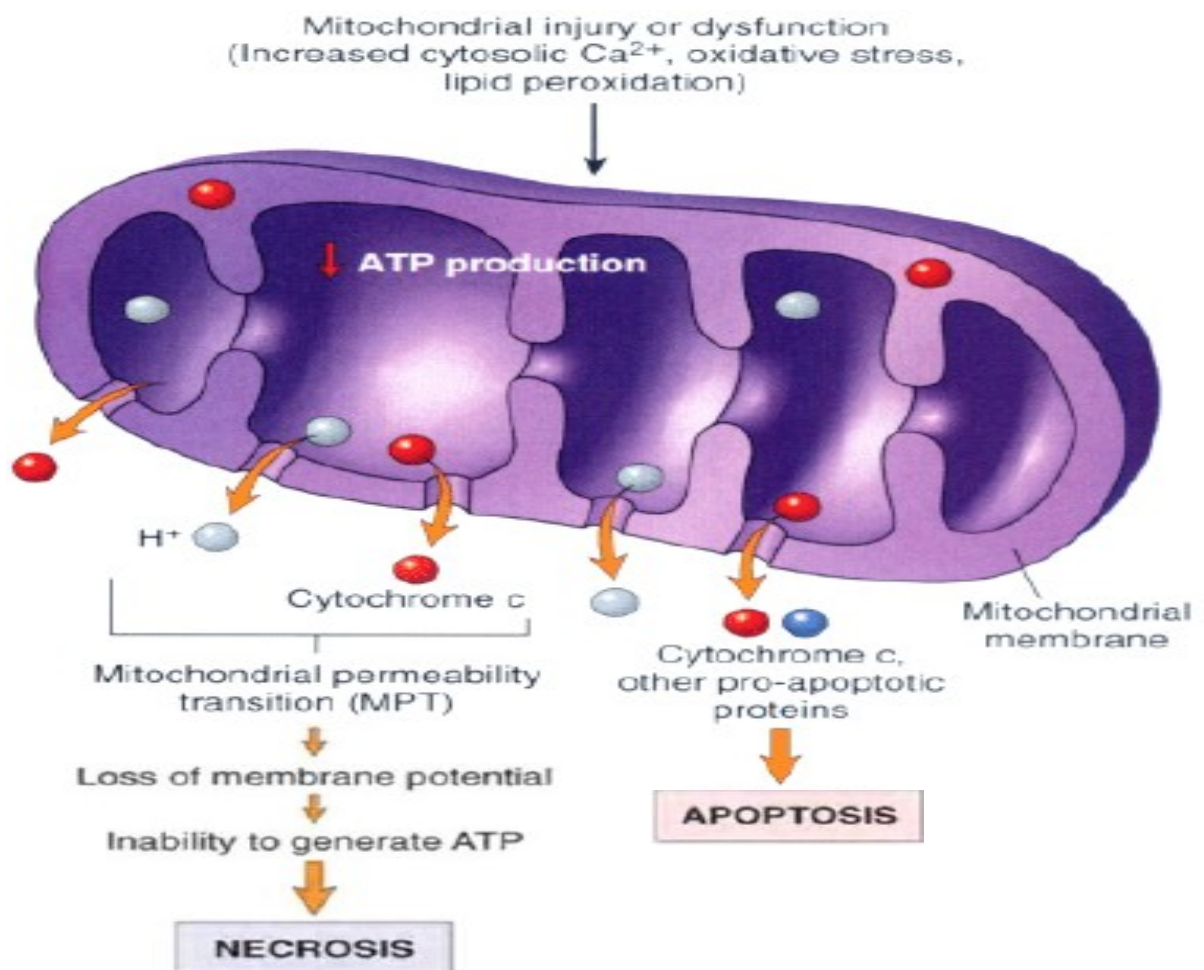


- Transport of lipids is carried by protein carriers, as lipids are water insoluble. Proteins help lipids to circulate the blood, or else they will remain in their major factory, the liver, leading to the fatty change\liver.

- Cytoskeleton (structural proteins) will also be affected by protein breakdown.

Calcium is an essential factor in the process of cell injury, since it's a cofactor for many enzymes. Many enzymes are normally inactive, but the presence of large amounts of Ca activates them.

The earliest phase of cell injury is mitochondrial change, the function of mitochondria will be damaged due to oxygen loss, which leads to decreased amounts of ATP.



In diseases functional changes usually happen before structural changes (morphology), but both depend on each other mostly.

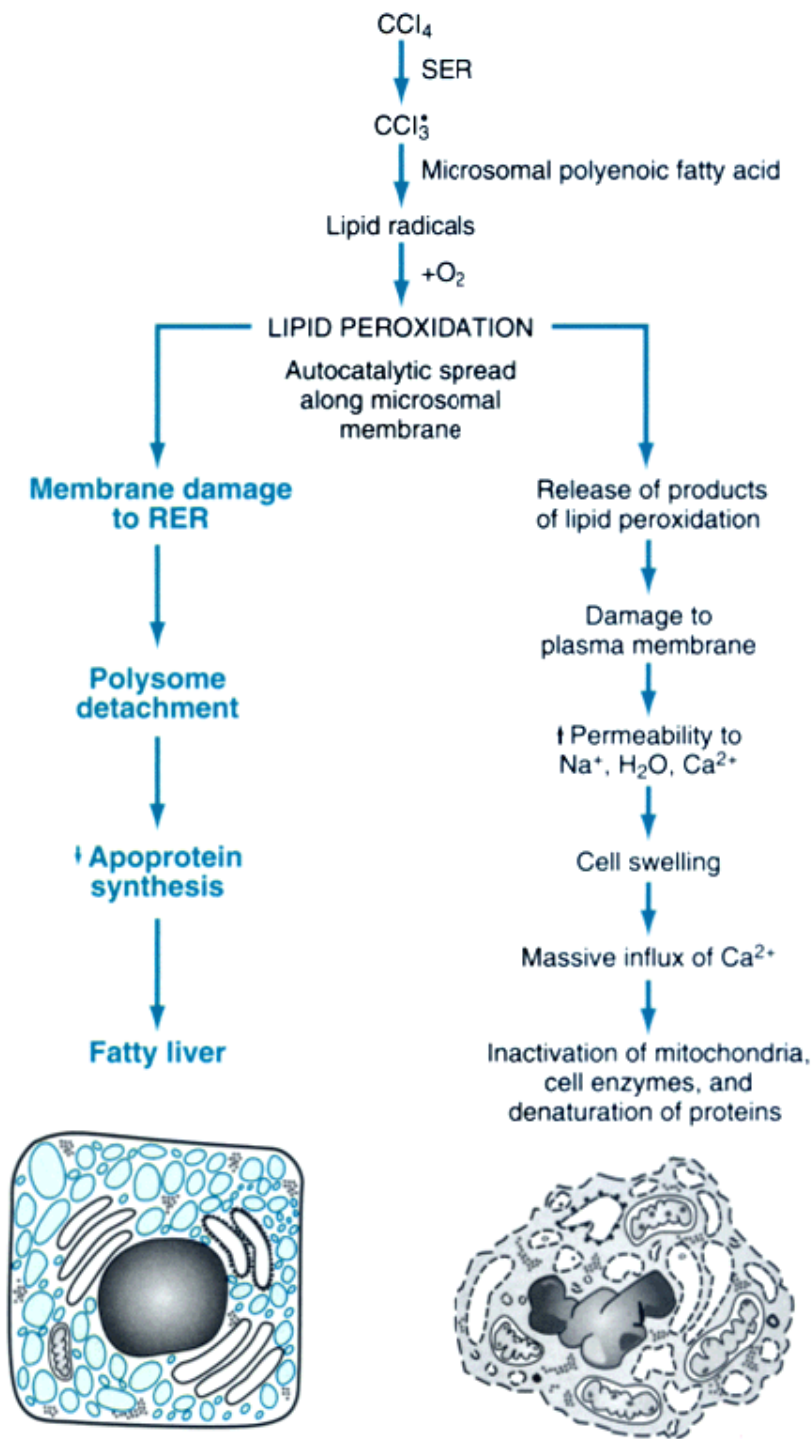
Antioxidant activity: natural substances act as enzymes to inhibit the activation of free radicals like catalyze. In food there is both vitamin E&A.

Chemical injury:

Some substances are ***considered biologically active*** by nature, if they have any contact with a certain body or cell they will affect it directly.

Other substances (in chemotherapy and antibiotics) cause chemical injuries as well, but the difference is that they were ***inactive*** converted into ***biologically active*** substances, by stealing an electron from the outer orbit leading to cell injury.

Free radicals are ***contagious***: by touching any cell component they convert it into a free radical, for example when free radicals come in contact with cell membrane lipids converting them (Lipid peroxidation).



Cellular response to injury

Some cells die immediately after getting injured. Some are put under pressure but still adapt.

Adaption of the cell differs depending on type of injury, cell type, duration and severity of the injury.

Adaptation: is a cellular response defined as a new steady state which lies between normal unstressed cell, and injured overstressed cell, in which the cell can function and preserve its viability.

** The type of cell adaptation during which the cell decreases the number of organelles and their size, in addition to decrease in cell size (ex. Caused by decrease of oxygen) is called **atrophy**.

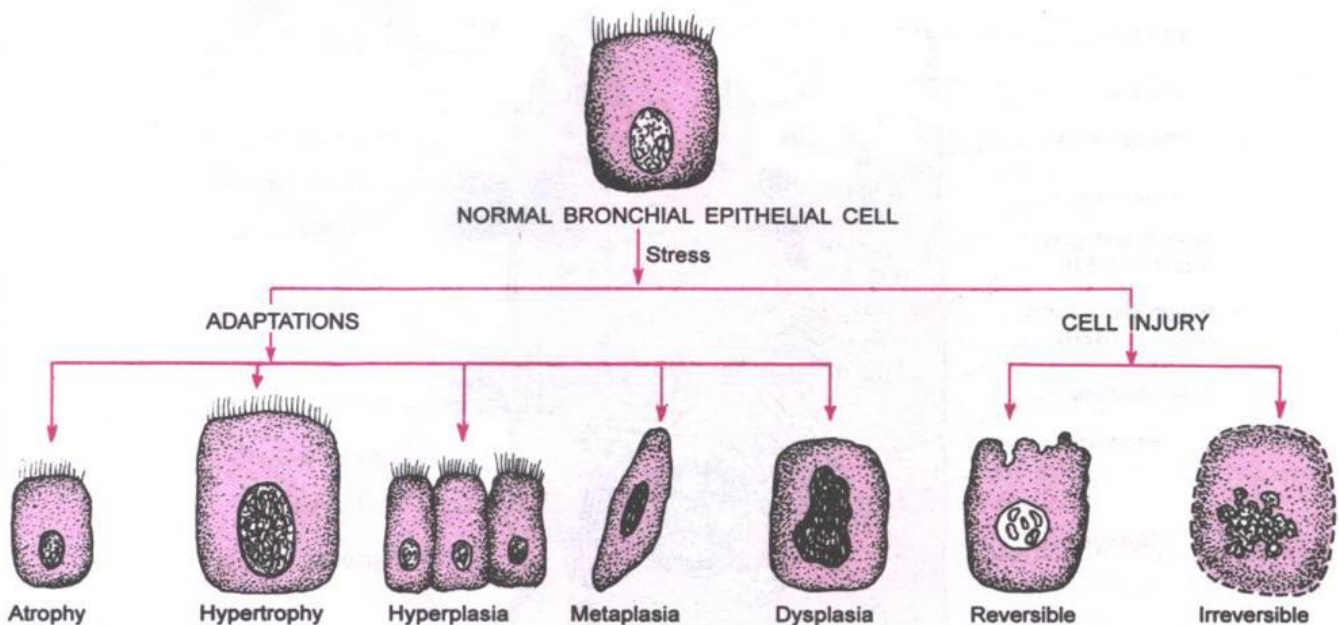
Causes of Atrophy:

1-Physiological: changes that occur in the cell, whether the cell gets smaller or bigger is normal (no abnormal activities). Ex. During pregnancy the uterus is supposed to get thicker, this is called physiological adaptation.

2-Pathological: the change\response is abnormal, shouldn't happen in that certain time. Ex. An old Granny (80 years old) happens to have an increase of the thickness of the endometrium (it's a pathological adaptation since menopause happened → endometrial hyperplasia)

How do Growth hormones induce their effects on the cell?

By binding between the growth hormone and receptor.



Hypertrophy: increase size of cell

Hyperplasia: increase number of cells

Metaplasia: transformation of cell from one type to another type

Aplasia: Lack of growth.

When a cell undergoes stress it adapts by performing one of these adaptation methods. Sometimes when we take the stress off, the cell can go back to normal (Reversible), and some cells go towards apoptosis (Irreversible).

Atrophy decrease in cell size, secondary to the decrease in the number of organelles. If a sufficient number of cells are reduced in size, the organ size will be reduced.

Causes: 1. cutting blood supply (Ischemic atrophy), 2. cutting off a nerve (denervation) 3. Decrease the workload of the organ

Down regulation and amount of protein also decreases -

-Reduction of protein synthesis

Increase of protein degradation

Atrophy: increases catabolism Proteolytic systems for degradation -

1) Lysosomal enzymes digest proteins.

2) Ubiquitin: is an abundant protein found in normal cells.

It tags the old or abnormal damaged proteins by binding to them, making an ubiquitin- protein complex. The tagged damaged protein is degraded by proteases and turned directly into amino acids to be synthesized again, meanwhile ubiquitin leaves to search for other damaged proteins.

**Hyperplasia doesn't occur in permanent cells, only in cells that divide

Both hypertrophy and hyperplasia occur simultaneously (happen together)

In cells that cannot divide hypertrophy happens alone.

Look up at the slides for examples (**