AGING AND APOPTOSIS

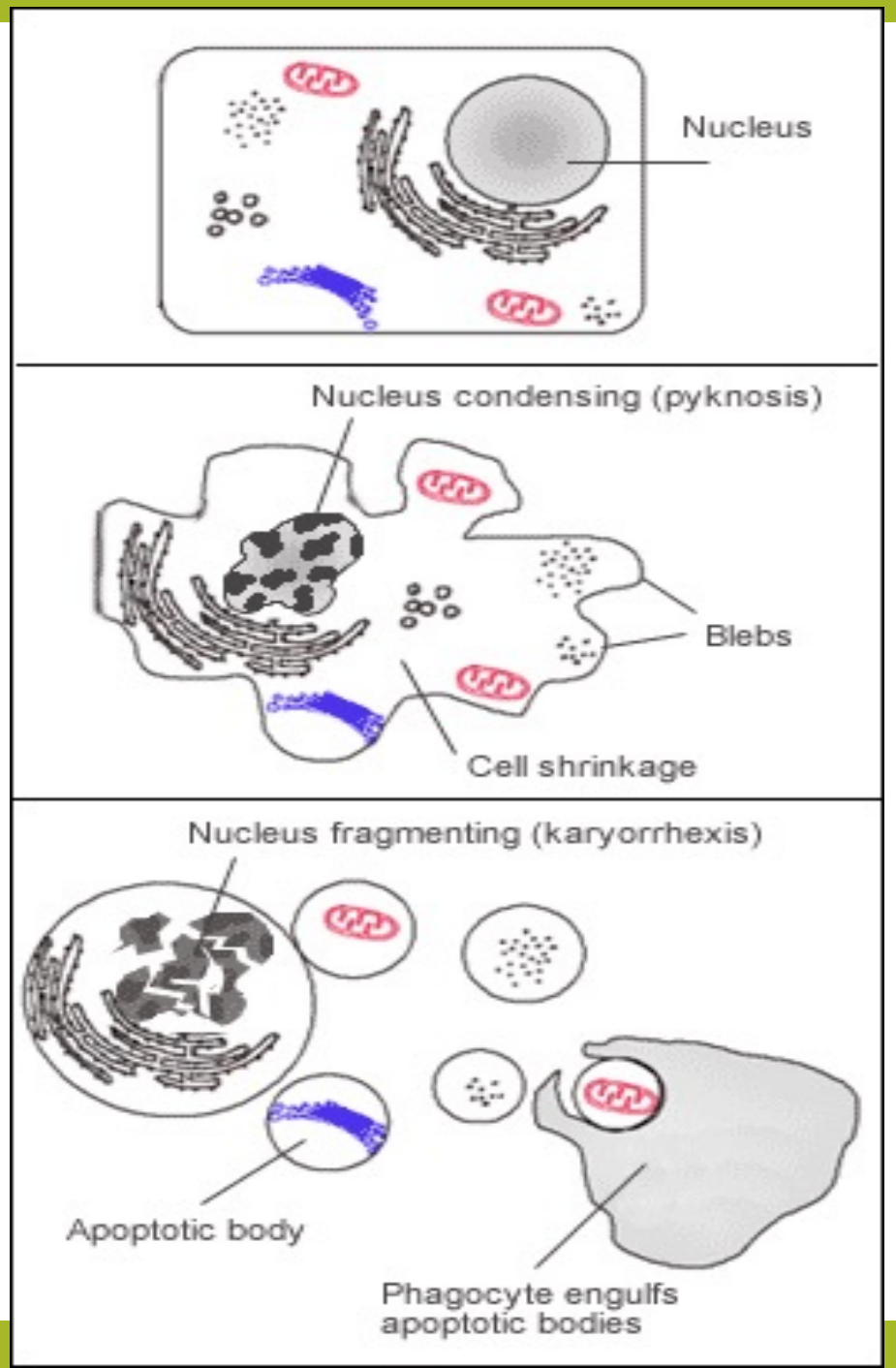
Ageing

Ageing is the process during which structural and functional changes accumulate in an organism as a result of the passage of time. The changes manifest as a decline from the organism's peak fertility and physiological functions until death.

Apoptosis is a form of programmed cell death that occurs in multicellular organisms
Apoptosis is a highly regulated and controlled process.
There are some changes take place in cell during apoptosis

- Blebbing
- cell shrinkage
- nuclear fragmentation
- chromatin condensation
- chromosomal DNA fragmentation
- mRNA decay.

For example, the separation of fingers and toes in a developing human embryo occurs because cells between the digits undergo apoptosis.



Apoptosis cannot stop once it has begun, it is a highly regulated process.

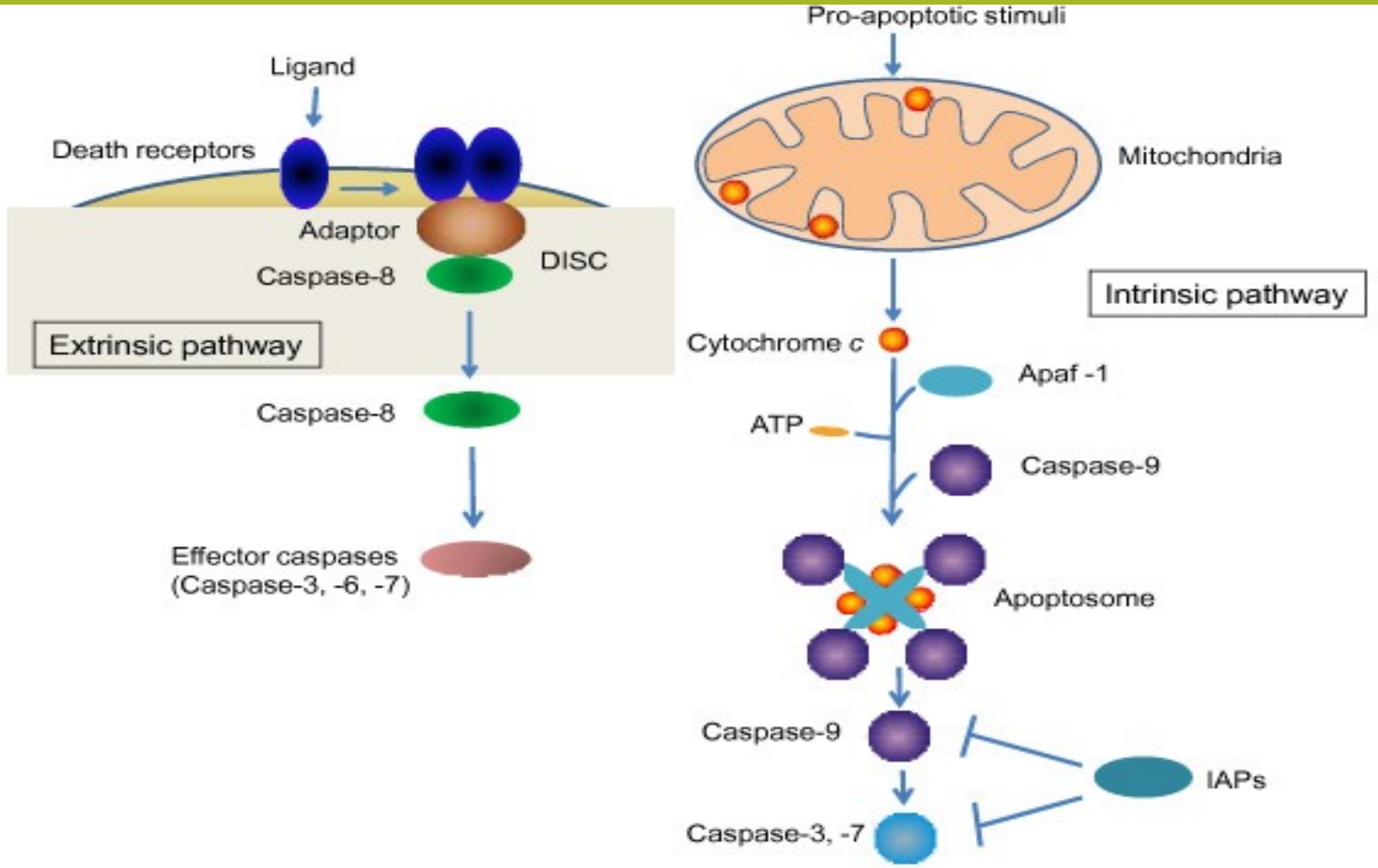
Apoptosis can be initiated through one of two pathways.

- **In the intrinsic pathway the cell kills itself because it senses cell stress.**
- **In the extrinsic pathway the cell kills itself because of signals from other cells.**

Both pathways induce cell death by activating caspases, which are proteases, or enzymes that degrade proteins.

Extrinsic Pathway: A signal is received from outside the cell instructing it to commit programmed cell death. This may occur if the cell is no longer needed, or if it is diseased.

- **Ligand bind with death receptor. This cause change in receptor.**
- **Due to that adaptor changes.**
- **Adaptor activate caspase 8.**
- **Caspase 8 activate caspase 3,6,7.**
- **This cause breakdown of DNA and hence apoptosis.**


Pro-apoptotic stimuli
Ligand
Death receptors
Mitochondria
Adaptor
DISC
Caspase-8
Intrinsic pathway
Extrinsic pathway
Cytochrome c
Apaf -1
ATP
Caspase-9
Caspase-8
Apoptosome
Effector caspases
(Caspase-3, -6, -7)
Caspase-9
IAPs
Caspase-3, -7

Intrinsic Pathway: The intrinsic pathway to apoptosis is triggered by stress or damage to the cell. Types of stress and damage that can lead the cell to apoptosis include damage to its DNA, oxygen deprivation, and other stresses that impair a cell's ability to function.

- **Mitochondria release Cytochrome-C**
- **Cytochrome-C in the cell cytoplasm prompts the formation of the ominous-sounding "apoptosome" – a complex of proteins that performs the final step to beginning cellular breakdown.**
- **The apoptosome, once it is formed, turns pro-caspase-9 into caspase-9.**
- **Caspase-9 performs several functions to promote apoptosis. Among the most important is the activation of caspases-3 and -7.**
- **Once activated, caspases-3 and -7 begin the breakdown of cellular materials. Caspase-3 condenses and breaks down the cell's DNA.**