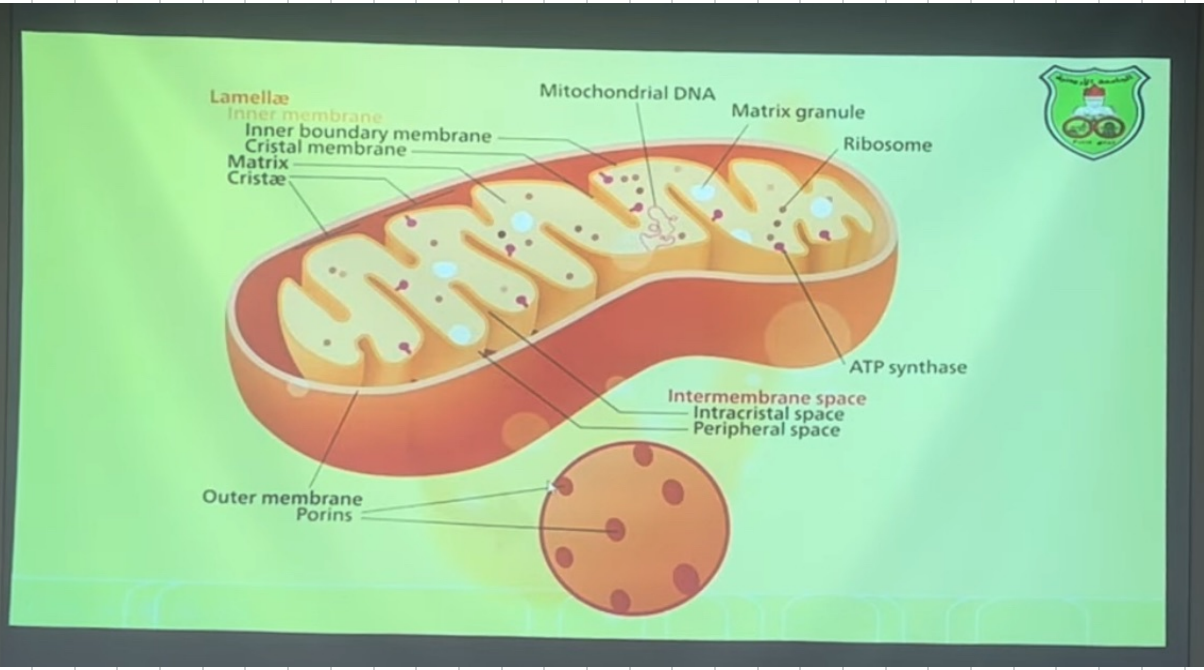


1) mito. has 2 membrane → outer, inner, matrix, inner mem. is bent and looped and has e^- transport chain machinery

2) between inner+outer, there's intermembrane space.

3) why is mito. is convoluted? to increase surface

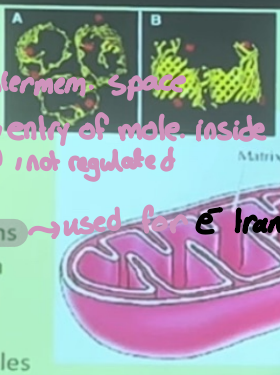
What are the mitochondria?

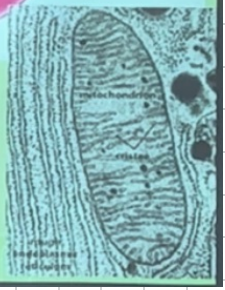
- Mitochondria are thought to have evolved from bacteria via endosymbiosis. mito. → bacteria fused with eukaryotic
- They play a critical role in the generation of metabolic energy → ATP in eukaryotic cells
  - Generation of ATP from the breakdown of carbohydrates and fatty acids
- They contain their own DNA, which encodes tRNAs, rRNAs, and 13 mitochondrial proteins.
  - But most mitochondrial proteins (~1500) are encoded by the nuclear genome.
- Most mitochondrial proteins are translated on free cytosolic ribosomes and imported into the organelle.

what made them think mito. is bacteria
- 2 membrane system since bacteria has cell wall + cell membrane
- has its own genetic and Chromosome of mito. is circular as bacteria

Structure

- Outer membrane anything can get inside intermem. space
  - permeable to small molecules (~1000 Da) → entry of mole. inside through mem. isn't regulated.
    - because of porins (channel proteins) → open / not regulated
- Inner membrane
  - contains a high percentage (>70%) of proteins → used for E transport chain
  - Forms folds (cristae) to increase surface area
  - Function; oxidative phosphorylation, ATP generation, transport of metabolites
  - impermeable to most ions and small molecules
- Intermembrane space → thing go out and in
  - Composition is similar to the cytosol
- Matrix →
  - contains the mitochondrial genetic system and the enzymes responsible for the Krebs cycle / metabolism
    FA oxidation (Beta)

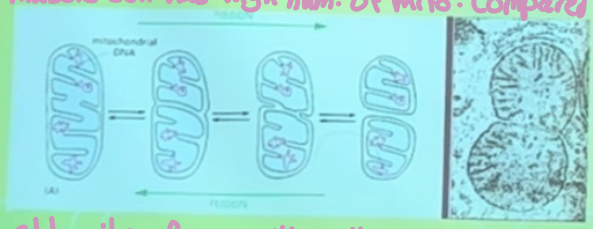


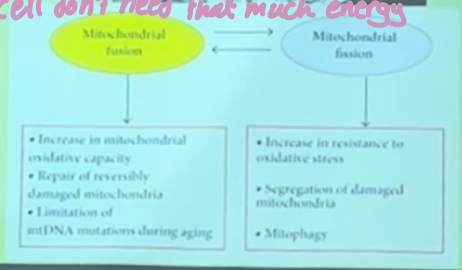


Properties and features

- They are located in cells requiring high-energy use such as synapses
  - ↳ means they're not randomly located in cell, located in places need more energy
- They are dynamic (fusion and division)
  - ↳ depend on needs of cell + state of mito.
  - Exchange genetic material
  - Regulate autophagy
  - Cell survival

muscle cell has high num. of mito. compared to cell don't need that much energy





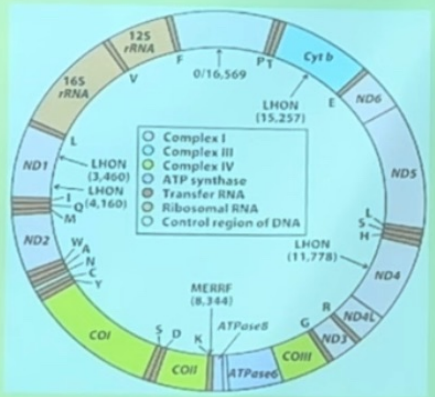
old mito. fuse with other one

1) old ppl get tired easily cuz mito. isn't effective as it was when he was young

The Genetic System of Mitochondria

mito. DNA → small, there's many copies of in mito (2-10) copy
→ circular

- Mitochondrial DNA (~16 Kb) is circular and exists in multiple copies per organelle.
- It encodes 13 proteins involved in electron transport and oxidative phosphorylation, rRNAs, and tRNAs.
- The oocytes are the main source of the mitochondria, meaning that mutations in the mitochondrial DNA are inherited from the mother.



mito. comes from mother
sperm useless when it come to organelle
ppl studied mito. DNA

Mitochondrial proteins

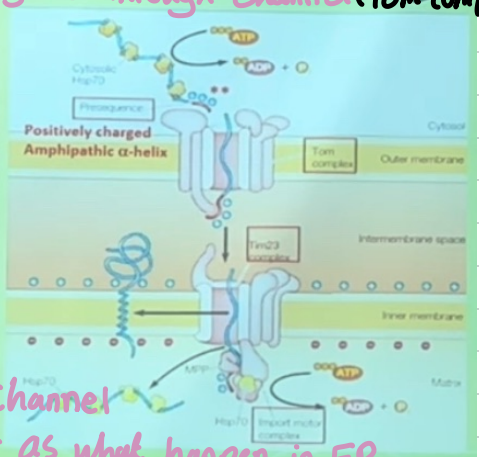
- The nuclear genome encodes for most mitochondrial proteins including those required for DNA replication, transcription, translation, oxidative phosphorylation, and enzymes for mitochondrial metabolism
- The proteins encoded by these genes (~99% of mitochondrial proteins) are synthesized on free cytosolic ribosomes and imported into the mitochondria as completed polypeptide chains.

most protein from nuclear DNA Not from mito-DNA

Protein Import and Mitochondrial Assembly

presequence → get recognize by certain protein and protein carry it inside outer membrane and goes through channel (Tom comp.)

- Proteins are targeted to the Tom complex in the mitochondrial outer membrane by N-terminal presequences.
- The protein passes through a channel (translocase) called the Tom complex on the outer membrane followed by passing through another channel (translocase) called the Tim complex in the inner membrane.
- The presequence is then removed and protein folding is completed.
- Some proteins with transmembrane domains exit The inner membrane channel laterally into the inner membrane.



transmembrane domain get recognized by Tim Channel and make protein on the inner membrane of mito. as what happen in ER

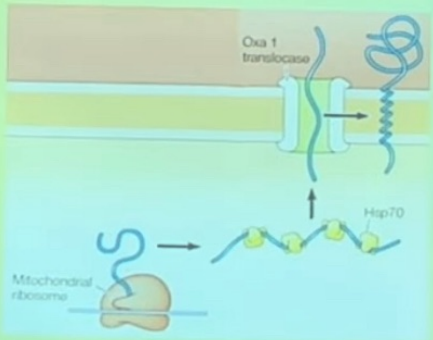
Tom → Translocase of outer membrane
Tim → " " inner membrane

- during the entry of protein inside mito presequence is cleaved off. and then folding happen inside mito.

Targeting of inner membrane proteins

13

- Some inner membrane proteins encoded by the mitochondrial genome are inserted via Oxa translocase.

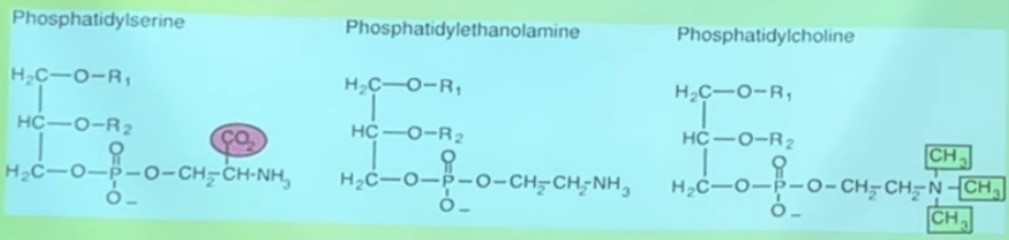


Tim translocase ⇝ insert protein inside mito. matrix or into inner membrane
Tom " ⇝ get protein inside through outer membrane
Oxa " ⇝ insert mitochondrial protein into inner membrane

Mitochondrial phospholipids

Phosphatidyl.serine ⇝ inside mito.

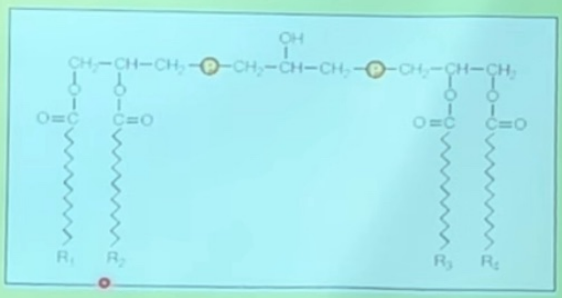
- Phosphatidylcholine and phosphatidylethanolamine are synthesized in the ER and carried to mitochondria by proteins.
- Phosphatidylserine can then be synthesized from phosphatidylethanolamine in the mitochondria.



mito	ER
phosphatidylserine	phosphatidylcholine phosphatidylethanolamine

Mitochondrial phospholipids
Cardiolipin

- The unusual phospholipid, cardiolipin, which contains four fatty acid chains, is also synthesized in the mitochondria.
- This molecule improves the efficiency of oxidative phosphorylation by restricting proton flow across the membrane.



- has 4 fatty acid chain
- produced from 3 glycerol molecules
* glycerol imp. for cardiac muscle, increase efficiency of $\bar{e}$ transport chain