Organelle Genomes

Organelles are the Energy (ATP) Factories of the Eukaryotic Cell

Mitochondria

- Found in both plants and animals

Chloroplast

- Found in plants

Both organelles are energy (ATP) factories

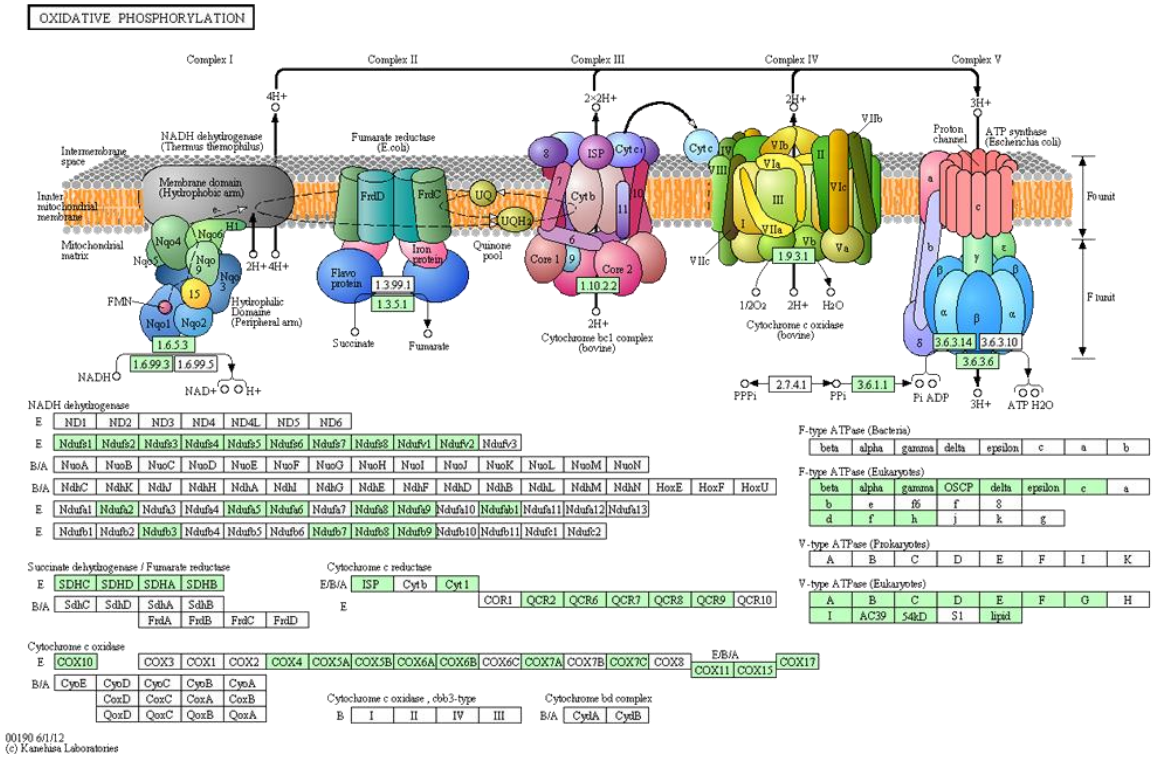
- Use an electron transport system to generate a H+ ion gradient
  - H+ gradient drives ATP production
- Electron transport requires a series of five protein complexes in both organelles
  - ATP production occurs via the ATPase complex

All complexes consist of nuclear and organelle encoded genes

- Organelle genes derived from bacteria genomes
  - Bacterial genes obtained by endosymbiosis

Electron Transport in the Mitochondria

http://mitofun.biol.uoa.gr/images/oxidative_phosphorylation.png



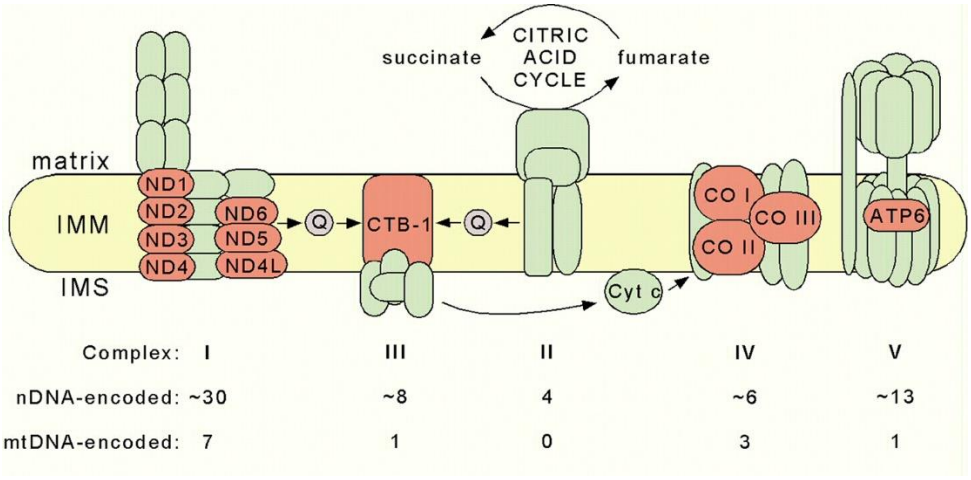
Mitochondrial function

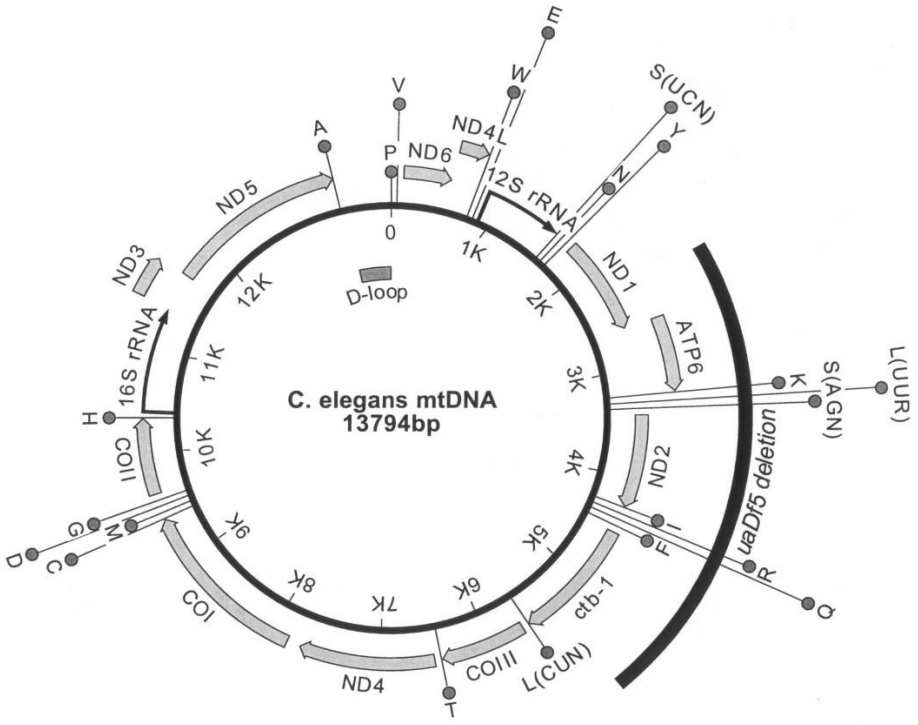
- ***Kreb Cycle: Electron Transport Chain***
  - ***Five protein complexes provide the functions***
  - Proteins encoded by **nuclear** **AND** **mitochondrial** genes
    - Most proteins of the five complexes encoded by ***nuclear genes***
    - A few encoded by ***mitochondrial genes***

Nematode Mitochondrial Genome

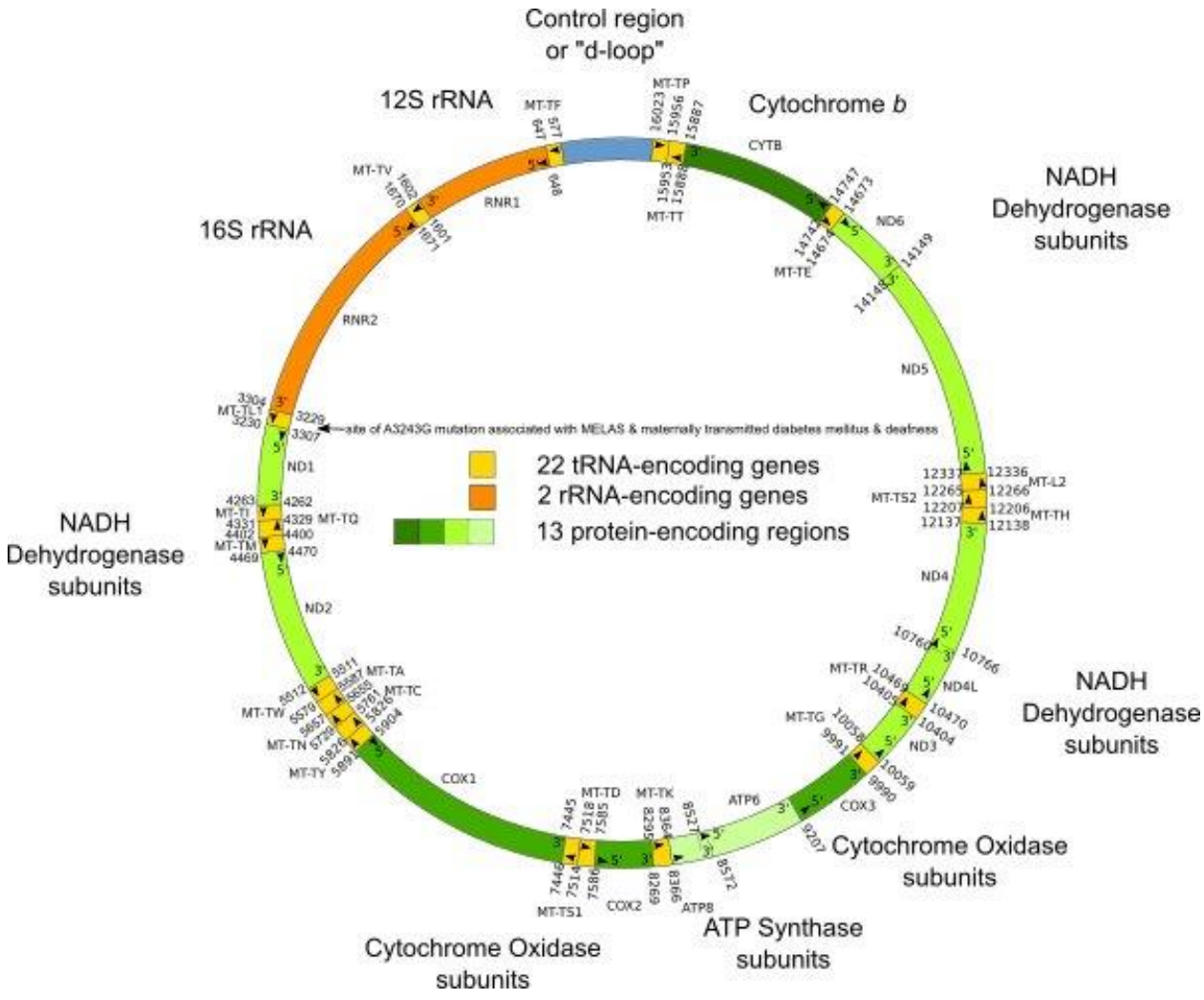
Electron Transport Chain Proteins

- Nuclear Encoded = ~60 proteins
- Mitochondrial Encoded = 12 proteins





Human Mitochondrial Genome



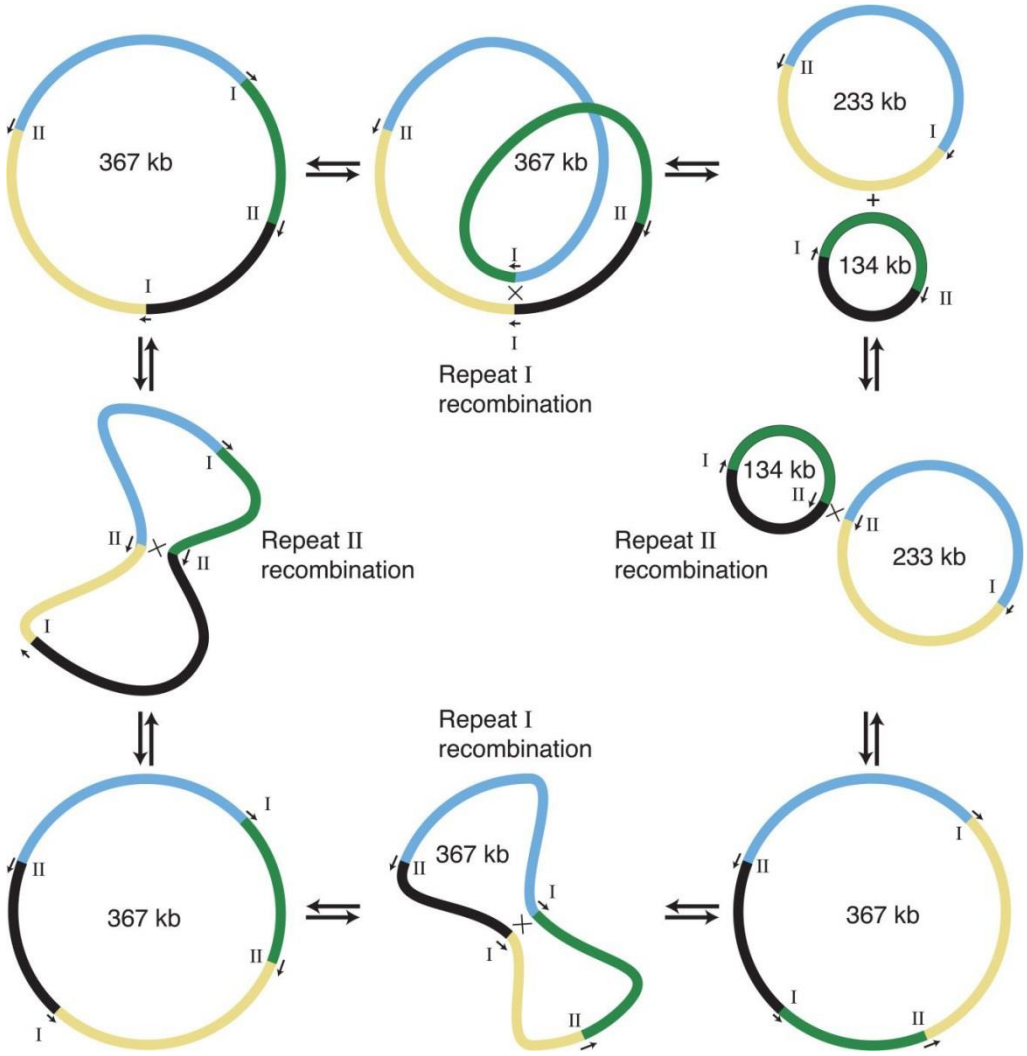
Human mitochondrial genome

- Small in size
  - 18kb
- Limited function
  - 13 protein encoding genes
  - Genes encode proteins related to electron transport activity

Plant Mitochondrial Genomes

Structurally Plastic Genome

http://6e.plantphys.net/topic12.06.html

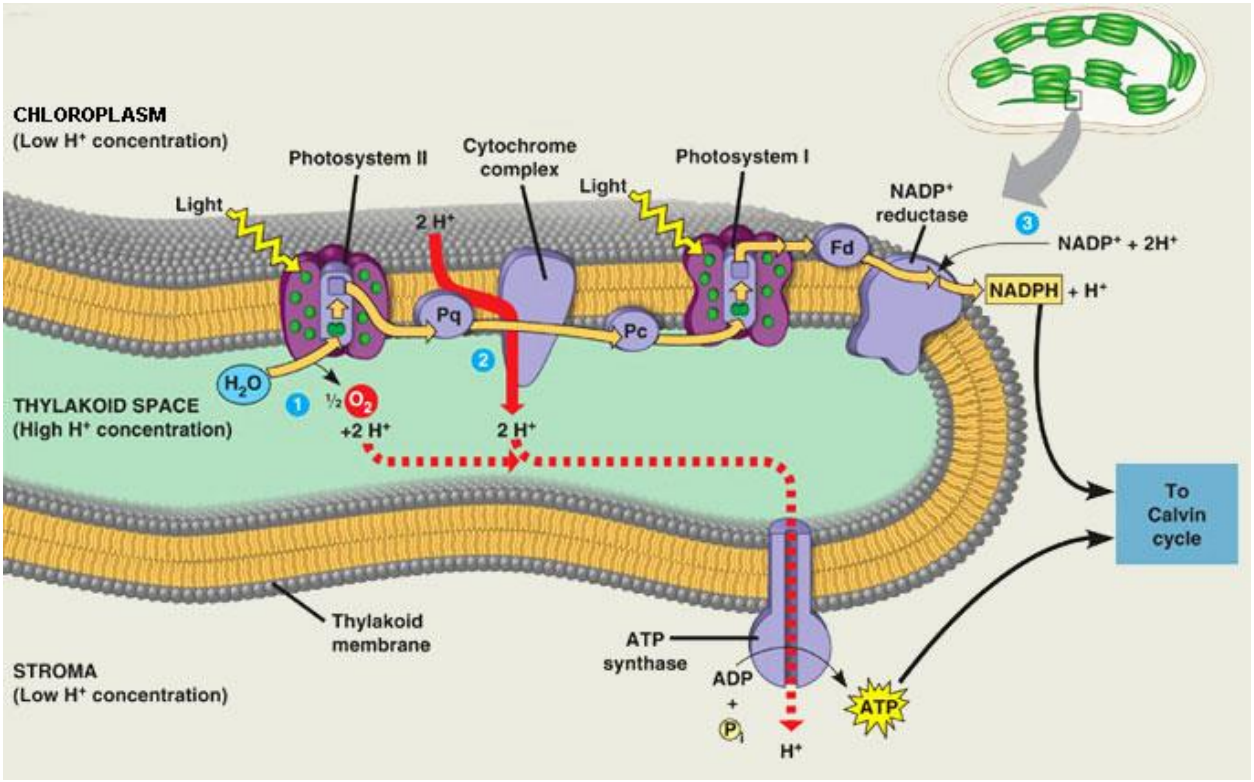


Arabidopsis genome

- Contains direct repeats
- Pairing of repeats can lead to structural changes through recombination
    - 367kb circular genome → 233kb + 134kb smaller circles
- Other plant mitochondrial genomes have more complex repeat/recombination patterns

Chloroplast Electron Transport

http://vle.du.ac.in/mod/book/print.php?id=10131&chapterid=16833

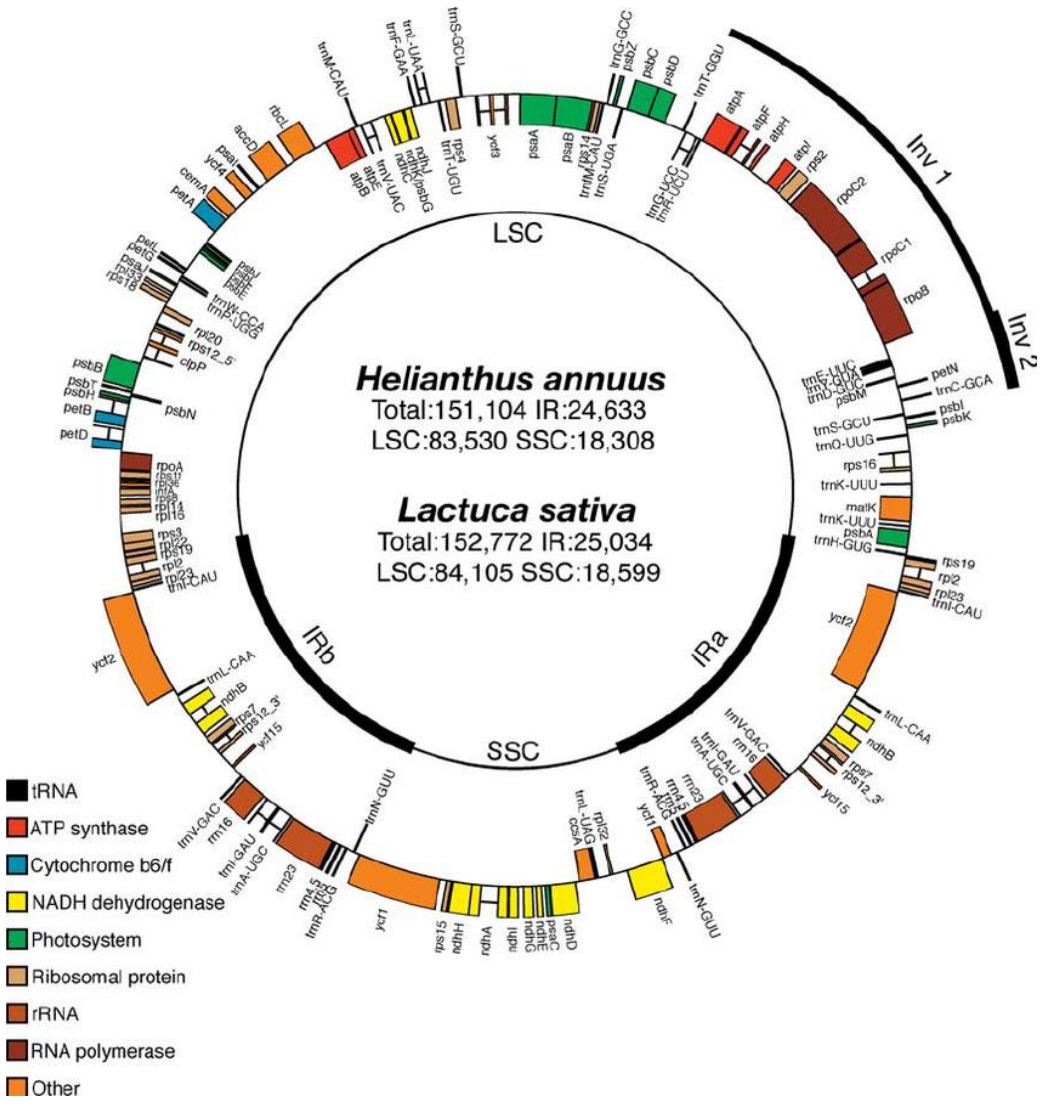


Chloroplast Function

Photosynthesis electron transport chain

- ***Five protein complexes provide the function***
  - Each complex has multiple proteins
  - Complex proteins encoded by both **nuclear** **AND** **chloroplast** genome genes

Chloroplast Genomes



Chloroplast genome genes

- Partial set of genes involved in photosynthesis
    - Light and dark reactions
    - Other genes encoded by nuclear genomes