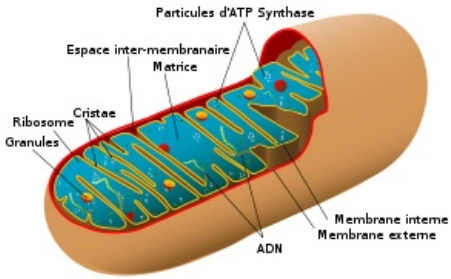
Genetic makeup of mitochondria

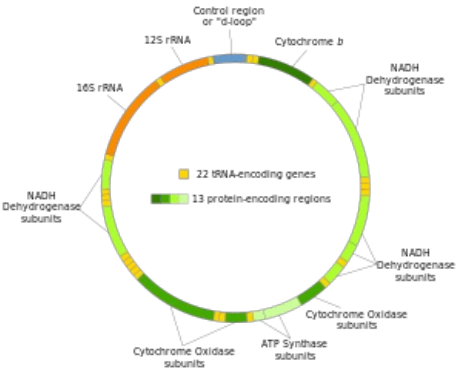
Mitochondria are semiautonomous organelles of eucaryotic cells. The origin of mitochondria is derived from symbiosis of *Archebacteria* (Prokaryote) with eucaryotic cells. During evolution *Archebacteria* lost their ability to exist independently and their presence became necessary for eucaryotic cell existence. One of the arguments of so called **endosymbiotic theory** is the analogy of keeping genetic information in mitochondria (and chloroplasts) and procaryotes on the other hand.



Mitochondria

Mitochondrial DNA

Mitochondrial DNA (mtDNA) is a circular double-stranded DNA (dsDNA). It doesn't form a complex with proteins and it doesn't have telomeres. A mitochondria contains tens of copies of mtDNA in its matrix, which encode synthesis of some of the components of this cellular organelle. The molecule of human mitochondrial DNA consists of 16 569 base pairs. It encodes biosynthesis of 2 rRNA for mitochondrial ribosomes, 22 types of tRNA and a serie of mRNA for protein synthesis (it contains 13 genes that encode proteins) − three subunits of cytochromoxidase, 1-2 subunits of F1-ATPase, 7 subunits of NADH-CoQ reductase and cytochrome b, maybe some other proteins as well. The genetic code is not always identical with the genetic code of nuclear DNA. Most of mitochondrial proteins are encoded by nuclear genes and they are transported to mitochondria from the cell cytoplasm. There is some degree of interaction between mitochondrial genome (mtDNA) and nuclear genome (gDNA). For example, the amount of mtDNA molecules is controlled at least by one nuclear gene. mtDNA plays an important role in cellular respiration; most of polypeptides that are needed for oxidative fosforylation are encoded by nuclear DNA. Mitochondrial genome is a bearer of **extranuclear inheritance**. The signs that are encoded by mtDNA are inherited exclusively from the mother (an oocyte contains about 100 000 molecules of mtDNA), it is called **matroclinic inheritance**. Mitochondrial DNA contains one significant "non-coding" sequence, so called D-loop. It is a short sequence of mtDNA, in which the heavy chain is displaced by DNA fragment (500 to 700 nucleotides), complementary to the light chain (it means that in this sequence, mitochondria has got three chain DNA). That is where the replication of so called heavy chain (marked with a letter H) starts, mentioned fragment works as a primer for the beginning of the replication. The start of the replication of the light chain (marked L) is placed outside the D-loop, in approximately two thirs of mtDNA.



Mitochondrial genome

Vegetal chloroplasts also have their own DNA that encodes synthesis of their rRNA, tRNA and subunits of different enzymes and regulatory proteins.

Links

Related articles

- Mitochondrial heredity (czech wikiskripta)
- Mitochondrial diseases
- Structure of nucleic acids (czech wikiskripta)

External links

- Database of mitochondrial genome MITOMAP (https://www.mitomap.org//MITOMAP)

References

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