

Topic 1: Introduction to cell biology and the cell's features

Learning objective 6: Explain the theory of the cell and the theory of endosymbiosis- examples?

Theory of the Cell:

3 components of the cell theory:

1. All organisms are composed of one or more cells
2. The cell is the basic structural and functional unit of all living organisms
3. Cells arise only from division of pre-existing cells

- Cells do not just spontaneously appear.
- Had to piece together many people's findings in order to create and cement this theory.

The theory was formulated in the mid 1800's.

Theory of endosymbiosis:

- the endosymbiont theory supports the belief that the mitochondrion and the chloroplasts originated from aerobic prokaryotes that lived in endosymbiosis an anaerobic prokaryote
- it is believed that the mitochondria and chloroplasts were cyanobacteria or another similar aerobic bacteria that were 'swallowed' by the cell
- Our ancestral eukaryote comes from the fusion of two prokaryotes, where one engulfed the other, i.e one prokaryotic cell living within in another one
- the internal membrane started forming which eventually lead to organelles, such as mitochondria and chloroplasts
- the primitive prokaryote becomes more complex and came to be multicellular

Evidence for endosymbiosis:

1. Morphology: Shape and size (um) of mitochondria and chloroplasts are similar to bacteria and archaea, they're both a little more than 1um
2. Reproduction: only by binary fission; eukaryotes don't do binary fission but the number of mitochondria and chloroplasts can fluctuate as they do binary fission without the whole cell having to do it
3. Genome: circular mDNA and cpDNA; mitochondria and chloroplasts have their own genome and their own DNA, which shows they could have originated at prokaryotes
4. Transcription and Translation: machinery is in place in order to perform transcription and translation, they are able to build proteins with their own DNA, they are the only two organelles able to produce their own proteins locally, stems from them being autonomous single celled organisms to begin with
5. Electron Transport: double membrane with ETC consisting of an inner -peptidoglycan layer; the ability to produce energy in this double membrane is what made these two prokaryotes desirable because the host prokaryote couldn't form its own aerobic energy
6. Sequence: bacterial branch of tree of life (mitochondria= proteo-bacteria; chloroplasts= cyanobacteria)

Still evidence of endosymbiosis occurring today:

- -ex. the spotted salamander and green algae are endosymbiotic, algae cells infiltrate the embryos and provide O₂, while they use the N₂ produced by the salamanders
- -ex. bacteria in our stomachs and coral reefs

- ex. sea slug steals the chloroplasts from a plant, the sea slug lives within the plant but its not symbiotic because it's not mutually beneficial, it steals the plant's chloroplasts to photosynthesis. This process is termed kleptoplasmy (klepto=steals; plasy=plastids)