

Louis Pasteur & Endosymbiotic theory

Pasteur https://www.youtube.com/watch?v=Q5nbU_V1ST

<https://www.youtube.com/watch?v=AndOnmx9cuM>

Pasteur boiled chicken broth in two set-ups of swan-neck flasks to ensure that all microorganisms were killed. In the first set-up, the neck of the flask was broken off and the broth inside became contaminated (experiment 1) .

In the second set- up, the curved neck of the flask prevented air from contaminating the broth inside, and so the broth inside remained sterile (experiment 2).

Pasteur concluded that cells come from pre-existing cells and do not spontaneously generate.

This was a great discovery with regard to microbes and the origin of cells.

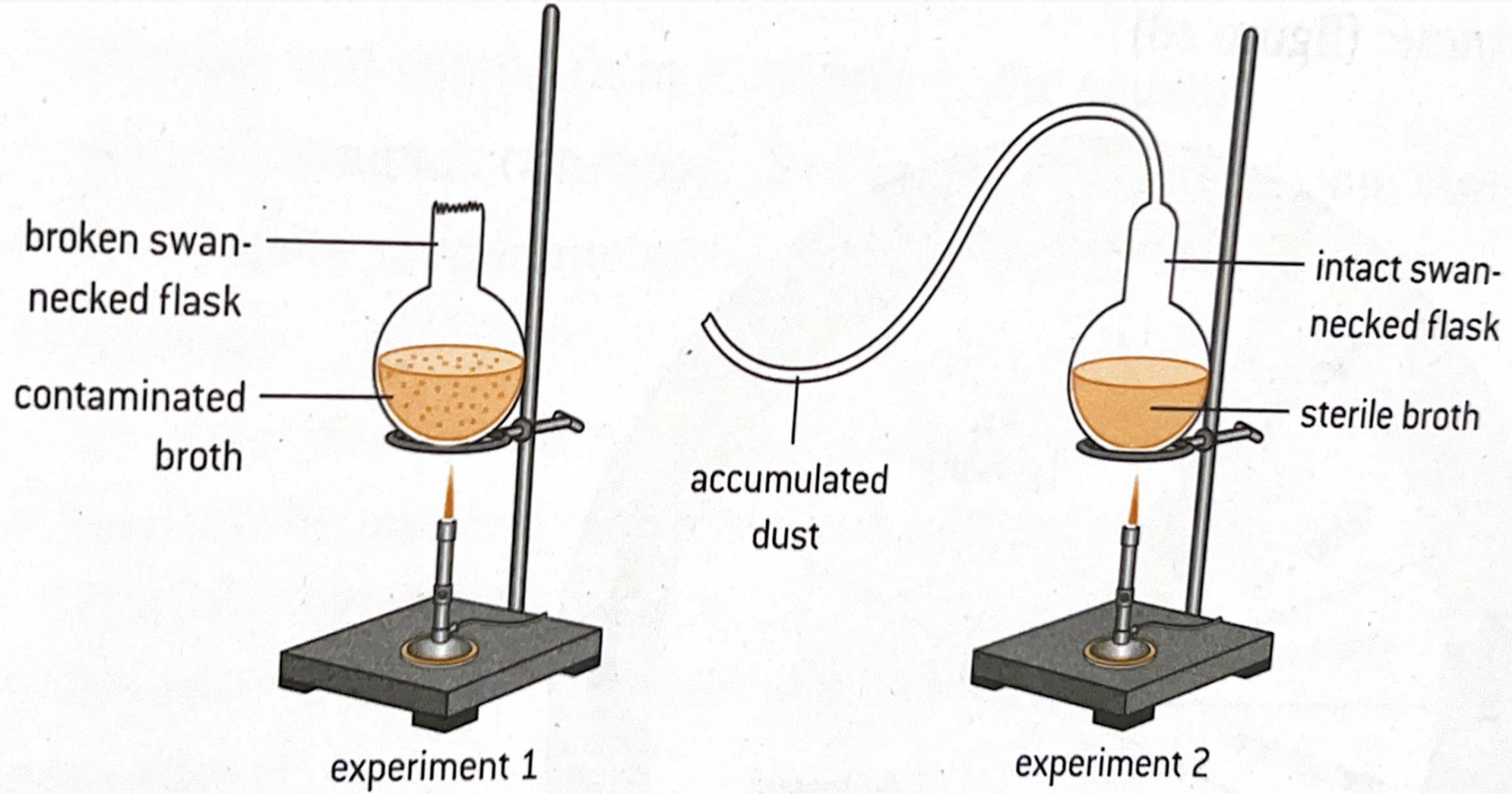


Figure 19. Pasteur's experiments

Pasteur's experiments provided evidence that cells come from pre-existing cells, *but how were the first cells formed?*

Many scientists believe that the first cells may have come from non-living material.

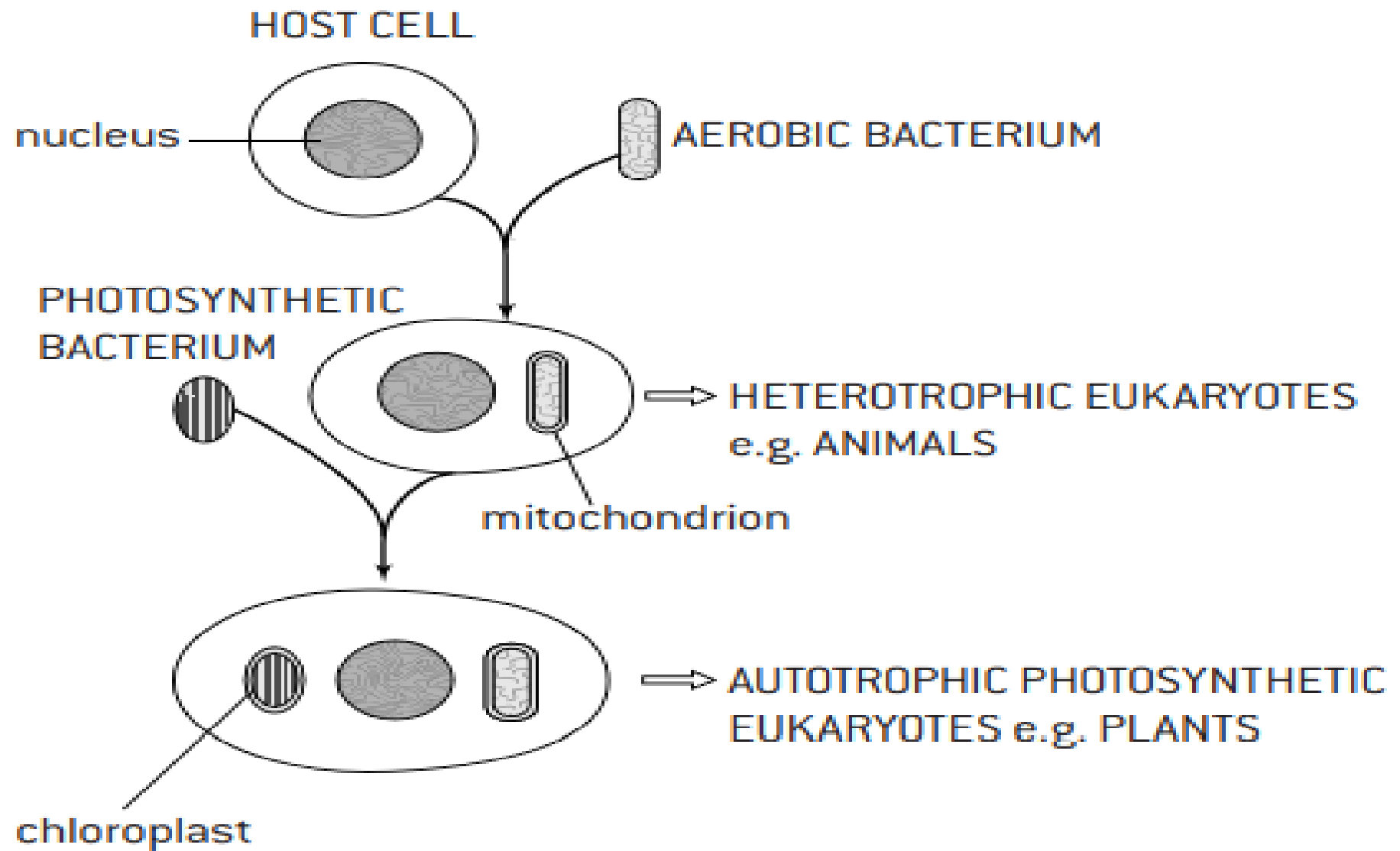
(Spontaneous generation)

In 1950, biochemists Stanley Miller and Harold Urey were able to produce simple organic compounds from inorganic compounds when simulating the conditions of the Earth.

Endosymbiotic theory <https://www.youtube.com/watch?v=FGnS-Xk0ZqU>
<https://www.youtube.com/watch?v=8oSqXAwLsZc>

Symbiosis is two organisms living together. With endosymbiosis a larger cell takes in a smaller cell by endocytosis, so the smaller cell is inside a vesicle in the cytoplasm of the larger cell. Instead of the smaller cell being digested, it is kept alive and performs a useful function for the larger cell. The smaller cell divides at least as frequently as the larger cell so all cells produced by division of the larger cell contain one or more of the smaller cells inside its vesicle. According to the endosymbiotic theory, this process happened at least twice during the origin of eukaryotic cells.

1. A cell that respired anaerobically took in a bacterium that respired aerobically, supplying both itself and the larger cell with energy in the form of ATP. This gave the larger cell a competitive advantage because aerobic respiration is more efficient than anaerobic. Gradually the aerobic bacterium evolved into mitochondria and the larger cell evolved into heterotrophic eukaryotes alive today such as animals.
2. A heterotrophic cell took in a smaller photosynthetic bacterium, which supplied it with organic compounds, thus making it an autotroph. The photosynthetic prokaryote evolved into chloroplasts and the larger cell evolved into photosynthetic eukaryotes alive today such as plants.



This theory explains the characteristics of mitochondria and chloroplasts:

1. They grow and divide like cells.
2. They have a naked loop of DNA, like prokaryotes.
3. They synthesize some of their own proteins using 70S ribosomes, like prokaryotes.
4. They have double membranes, as expected when cells are taken into a vesicle by endocytosis.