

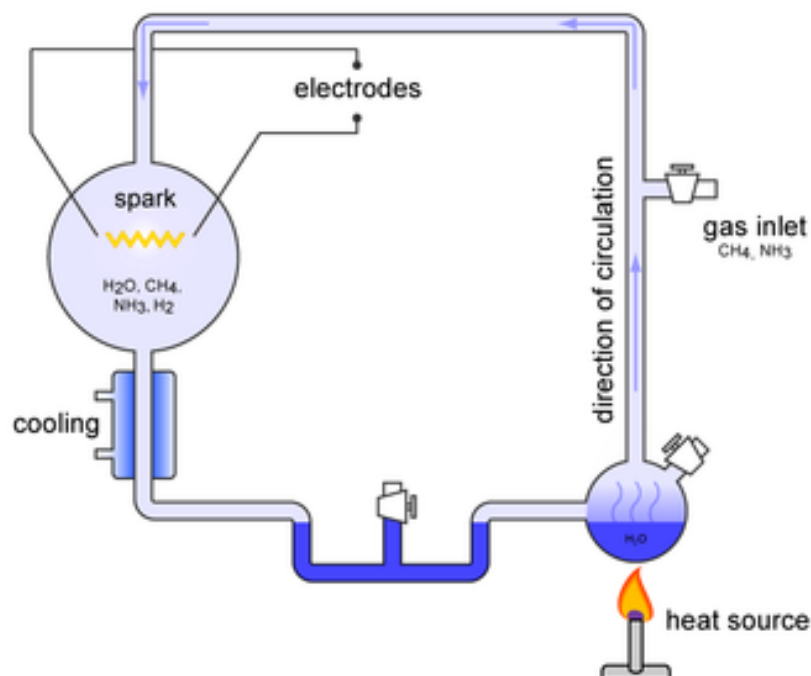
1.5 Origin of Cells

Synthesis of Life

Describe the four processes needed for the spontaneous origin of life on Earth

1. There was non-living synthesis of simple organic molecules (from primordial inorganic molecules)
2. These simple organic molecules became assembled into more complex polymers
3. Certain polymers formed the capacity to self-replicate (enabling inheritance)
4. These molecules became packaged into membranes with a distinct internal chemistry (protobionts)

Outline, with the aid of the diagram, the Miller-Urey experiment into the origins of organic compounds



Water was boiled to vapour to reflect the high temperatures common to Earth's original conditions

The vapour was mixed with a variety of gases to create a reducing atmosphere (no oxygen)

This mixture was then exposed to an electrical discharge (simulating effects of lightning as energy source)

The mixture was then allowed to cool (concentrating components) and left for a period of ~1 week

Later, the condensed mixture was analysed and found to contain traces of simple organic molecules

Identify the conditions needed for the non-living synthesis of organic matter (and potential locations)

Conditions: Reducing atmosphere (no oxygen), high temperatures (>100°C) or electrical discharges

Locations: Volcanoes, hydrothermal vents, meteors (panspermia)

Outline the evidence from Pasteur's experiments that demonstrates that abiogenesis no longer occurs

Broths stored in vessels with long tubings (swan neck ducts) that can prevent passage of dust particles

The broths were boiled to kill any micro-organisms present in the growth medium (sterilisation)

Growth only occurred in the broth if the flask was broken open, exposing the contents to contaminants

From this it was concluded that bacterial growth came from contaminants and did not spontaneously occur

Outline two properties of RNA that would have allowed it to play a role in the formation of life

1. Can self-replicate (although superseded by DNA due to double strands increasing stability)

2. Can act as catalyst (although superseded by proteins due to greater variability in subunits)

Endosymbiosis

Describe the process of endosymbiosis and how it led to the evolution of eukaryotic cells



An endosymbiont is a cell which lives inside another cell with mutual benefit

Eukaryotic cells are believed to have evolved from early prokaryotes that were engulfed by phagocytosis

The engulfed cell remained undigested as it contributed new functionality to the engulfing cell

Over generations, the engulfed cell lost its independent utility and became a supplemental organelle

Outline the evidence supporting the theory of endosymbiosis

Component	Evidence
Membranes	Chloroplasts / mitochondria have double membranes
Antibiotics	Chloroplasts / mitochondria susceptible to certain antibiotics
Division	Chloroplasts / mitochondria divide by a fission-like process
DNA	Chloroplasts / mitochondria have own circular DNA
Ribosomes	Chloroplasts / mitochondria have 70S ribosomes

