

ORIGINS OF LIFE, CELL THEORY

20 June 2016

Campbell 10th:

Cell theory
cells
origins

p 4

p 93-138

p 56-58

Sadava: origins: 62

What is the nature of life, how did it originate? Religions, of course, hold that creation was by a divine hand.

MATTER: Organic versus inorganic...

During the scientific revolution, distinction was made between organic (vital) and inorganic (mineral).

In 17th-19th century, **two schools of thought**: Epitomized by the Vitalists versus Mechanists:

	matter	natural laws	origins?	Heated?	spont. gen?
Vitalists	organic qualitatively different from inorganic	involves "anima", different laws apply	Organic cannot be made from inorganic	inorganic melts organic cooks	No
Mechanists	all matter the same	all laws of nature apply	interconvertable		Yes

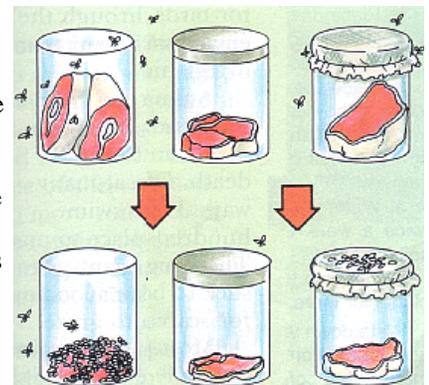
Spontaneous Generation

mechanists thought life could arise spontaneously (van Helmont: mice from dirty clothes and corn)

NOTE: Elements of truth in each. *Neither* was 100 % CORRECT...

EXPERIMENTS:

- Redi** 1668 maggots not form if flies screened out.
- Needham** 1745 Boiled meat broth, placed in clean flasks, spoiled
- Spallanzani** 1765 boiled meat broth inside flask, sealed, stayed sterile (no anima?)
- Lamarck** 1815 suggested that gelatinous masses, in presence of heat and electricity, cause *orgasme*.
- Pasteur** 1861 Swan necked flasks allowed in postulated "anima" (p 64)
- Wohler** 1828 synthesized urea, an organic molecule, fr ammonium cyanate (NH₃OCN) laws of chem and phys apply to biology, **vitalism** incorrect
- Liebig** 1838 declared that all organic molecules could be produced by chemical means



CELL THEORY:

- Leeuwenhoek (1632-1723) first observed microorganisms, improved microscope
- Hook (1635-1703) 1665 published first report of cells in cork
- Schleiden & Schwann (1838, 1839) Botanist and Zoologist combined: Unified cell theory
- Virchow (1858) "Omnis cellula e cellula" unbroken continuity of cells

Lamarck, Oparin, Miller

All suggested that natural processes could, in very unusual circumstances, trigger creation of organism.

Lamarck proposed electricity as trigger to 'orgasme'

Ernst Haeckel (~1866) theorized "primordial slime" = "Urschleim" as the precursor to life

Oparin and Haldane (1920s) proposed natural production of precursor molecules:

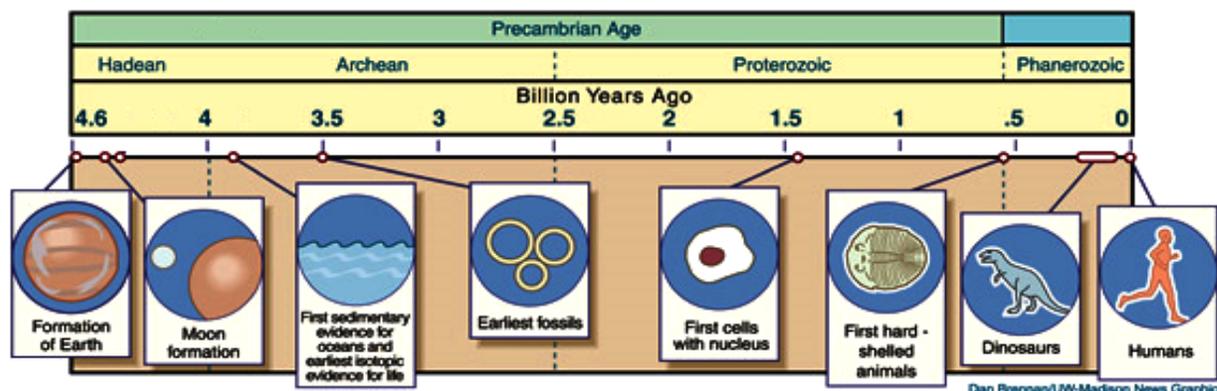
1. Reducing environment (O₂ free atmosphere), resulting in preservation of any formed organic molecules.
2. Electrical storms converted atmospheric methane, ammonia, nitrogen, CO₂ into complex organic molecules

Stanley Miller tried in 1953: (p. 57)

water, methane, ammonia, hydrogen, electric spark, **water cycle**.

Time line (p 523, 527)

- prokaryotes 3.8 billions years ago p chemotrophic
- oxygen synth 2.7 billion p chemicals ran low, photosynthesis used to capture energy
- first eukaryotes 2.1 billion p endosymbionts developed
- multicellular eukaryotes 1.5 billion



Dan Brennan/UW-Madison News Graphic