

Who should get the Nobel prize

By Michael Pittelkow

Who are my all-time favorites?

Those with grand ideas:

- Bohr (the atomic model), Van't Hoff (he didnt even get the prize for the discovery of the tetravalent carbon), Pauling (protein alpha-helix and beta-sheet structures), Watson and Crick (the DNA double helix)...

Those with cool discoveries:

- Grignard (and his reaction), Marie Curie (discovery of radioactive elements and their isolation)...

The great master of synthesis:

- Robert B. Woodward

The old masters of supramolecular chemistry:

- Lehn, Pedersen and Cram



And the prize goes to...



Prof. John D. Sutherland

- Laboratory for Molecular Biology, Cambridge, UK

For contributions to the understanding of the chemical origins of life (on earth).

Abiogenesis [a: *without*, bios: *life*; genesis: *origin*]
Biological life arises from inorganic matter through natural processes.

Not many, but only (very) significant papers!
Nature Chemistry 2015, 7(4), 301-307.
Nature, 2009, 14, 459, 239-242.

He would be the 10th Nobel prize winner from LMB and the 92nd from Cambridge in total, and the 22nd in chemistry from Cambridge.



The chemical origin of life

Life on earth

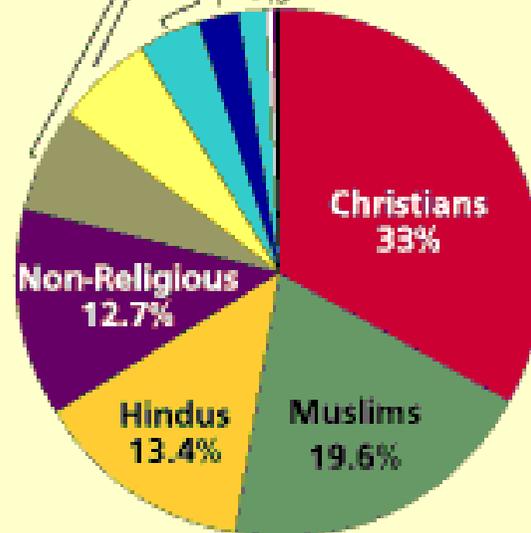
- 3.7 billion years
- Earth was form

Wiki says:
The origin of
yet solved. T
facts.

Religious Adherents as a Percentage of World Population in 2000

Figure 2

Atheists 2.5%
Ethno Religionists 3.8%
Buddhists 5.9%
Chinese Folk 6.4%
New Religionists 1.7%
Sikhs .4%
Jews .2%
Others .4%



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So what are the theories then?

A series of more or less crazy theories exist:

1: Panspermia: Life exists in the entire universe and has arrived with asteroids, planetoids etc.. Probably the life-form that travels is bacteria.

2: Spontaneous generation: According to Aristotle it was a readily observable truth that aphids arise from the dew which falls on plants, flies from putrid matter, mice from dirty hay, crocodiles from rotting logs at the bottom of bodies of water, and so on. **After ca. 2000 years this nonsense idea went away!**

3: Creationism:...oh god! **Still there...**

4: Abiogenesis: Biological life arises from inorganic matter through natural processes. What we will discuss today.



What came first?

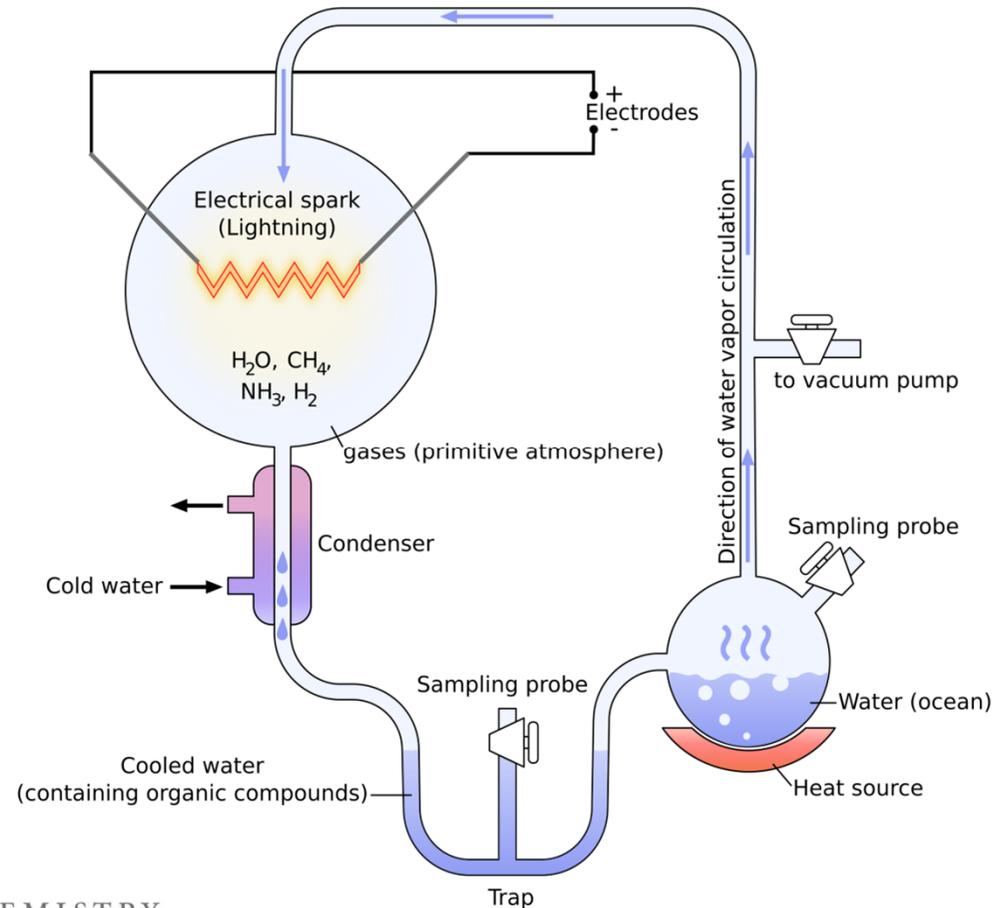
The cell is a set of subsystems...RNA, DNA, amino acids and lipids

- DNA? No...surely RNA must have come first!
- RNA? Maybe? 'Darwinian evolution needs informational molecules, so RNA must have come first'
- Metabolism first...
- Proteins? But...we need DNA to make proteins...
- Amino acids? But how are they formed? And how are they connected?
- Lipids? Surely they are needed for cells! But were they first?
- .
- .
- .
- Maybe everything started at the same point?



The Miller-Urey experiment (1953)

- Considering the theory that early earth atmosphere was reducing - probably consisted of hydrides: H_2 , H_2O , NH_3 , SH_2 , CH_4
- There was probably lots of lightning back then...energy!



John D. Sutherland

- Life started out of the blue (HCN blausäure):

The cell is a set of subsystems...RNA, DNA, amino acids and lipids. Perhaps they were made from common precursors?

Requires prebiotic conditions containing UV-light, H₂S, Cu(I)/Cu(II) redox pair, H₂O HCN

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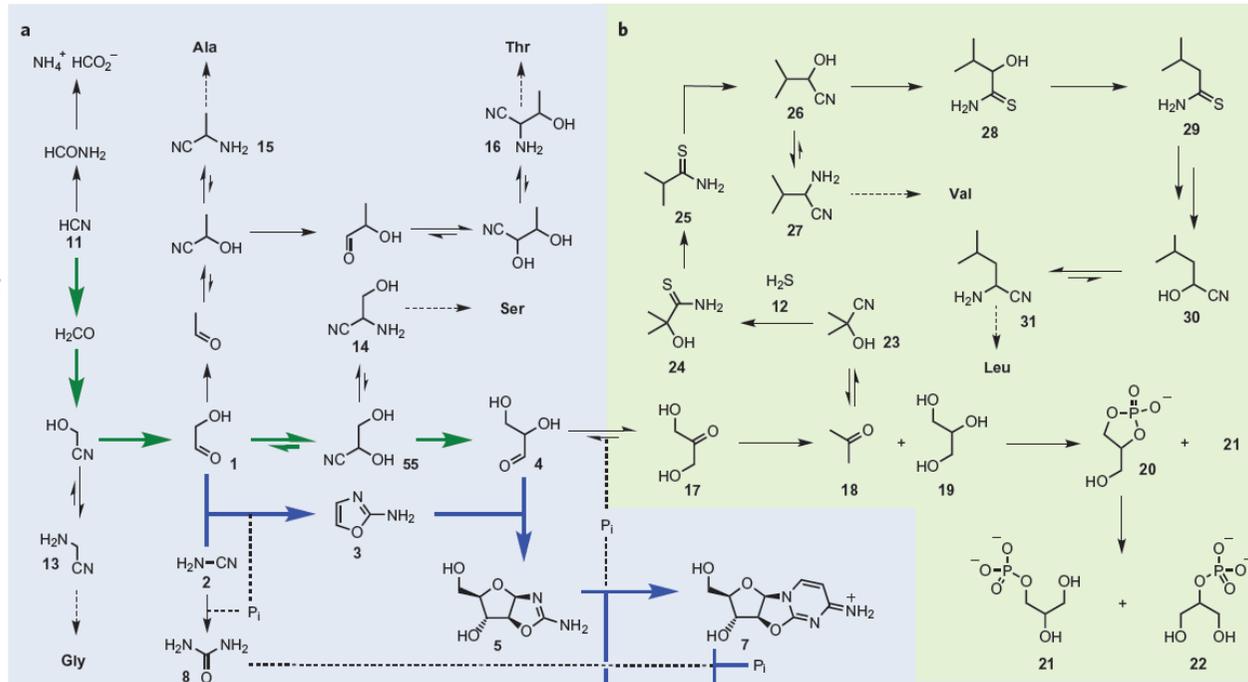
PUBLISHED ONLINE: 16 MARCH 2015 | DOI: 10.1038/NCHEM.2202

Common origins of RNA, protein and lipid precursors in a cyanosulfidic protometabolism

Bhavesh H. Patel, Claudia Percivalle, Dougal J. Ritson, Colm D. Duffy and John D. Sutherland*

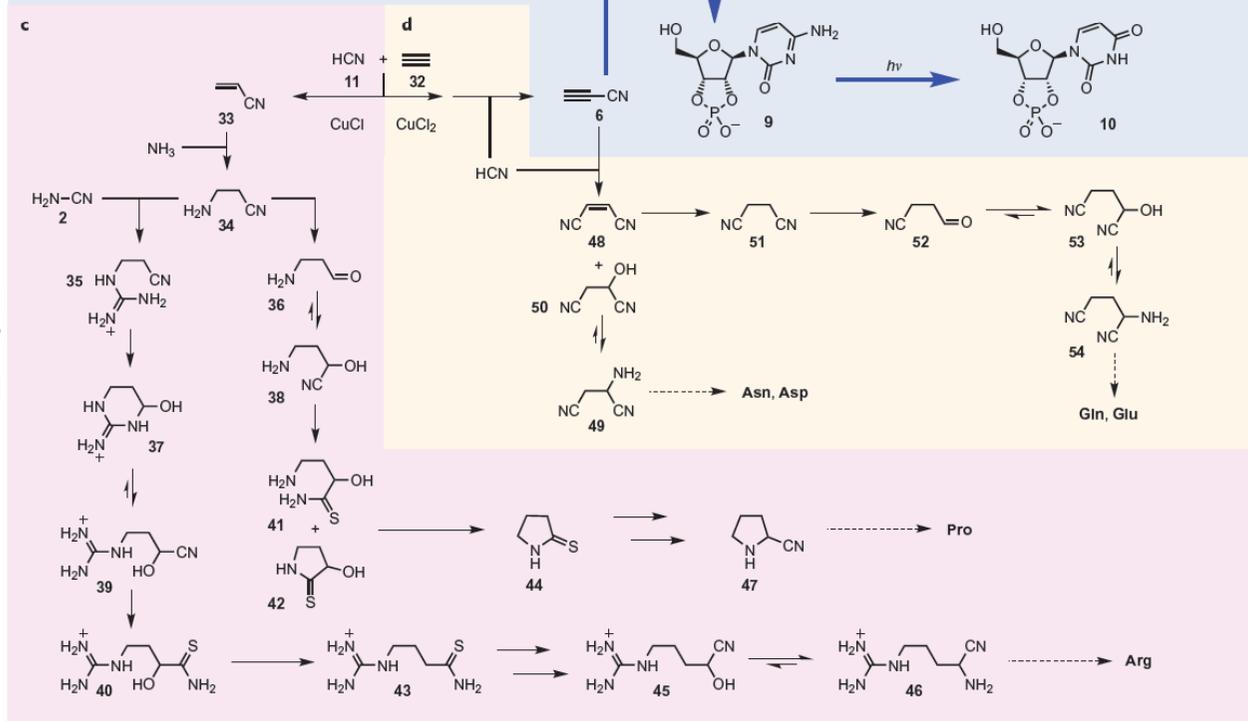


**Reductive
homologation of
HCN...ultimately
nucleotide
formation**



**Reductive of
dihydroxy-
acetone**

**Cu(I) catalysed
cross-coupling of
HCN and
acetylene
(acrylonitrile)**



**Cu(II)
catalysed
cross-
coupling of
HCN and
acetylene
(cyanoacetylene)**

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There is a lot we don't know

More questions:

Why did life start? *Well...thermodynamics wins.*

What about chirality? *The jury is still out.*

How does life know what to do? *That's meta!*

Who/what tells it? *Don't know...but I'd like to know!*

We are constantly out-of-equilibrium! *Life is not equilibrating under thermodynamic control...we constantly need energy!*



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