

A2.1

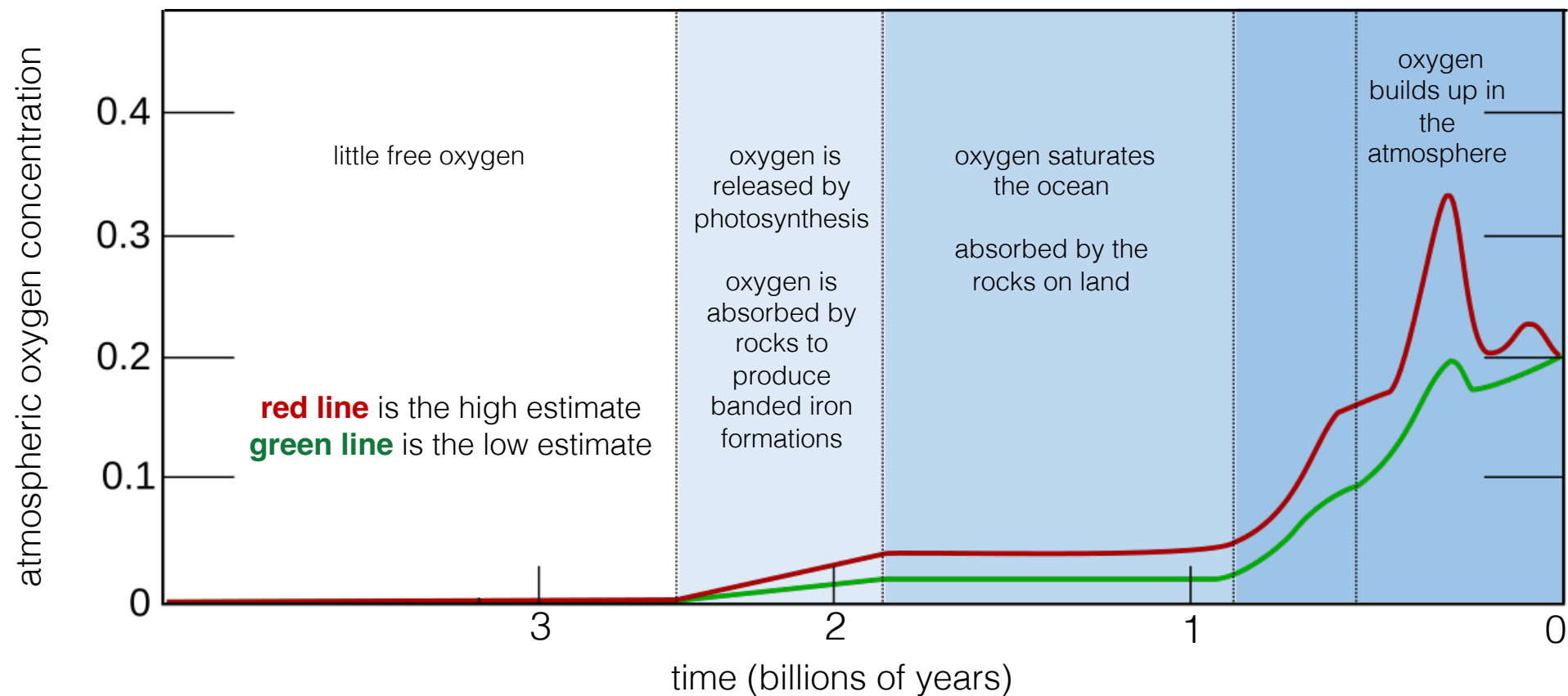
Cell Origins

What plausible hypothesis could account for the origin of life?

What intermediate stages were there between non-living matter and the first living cells?

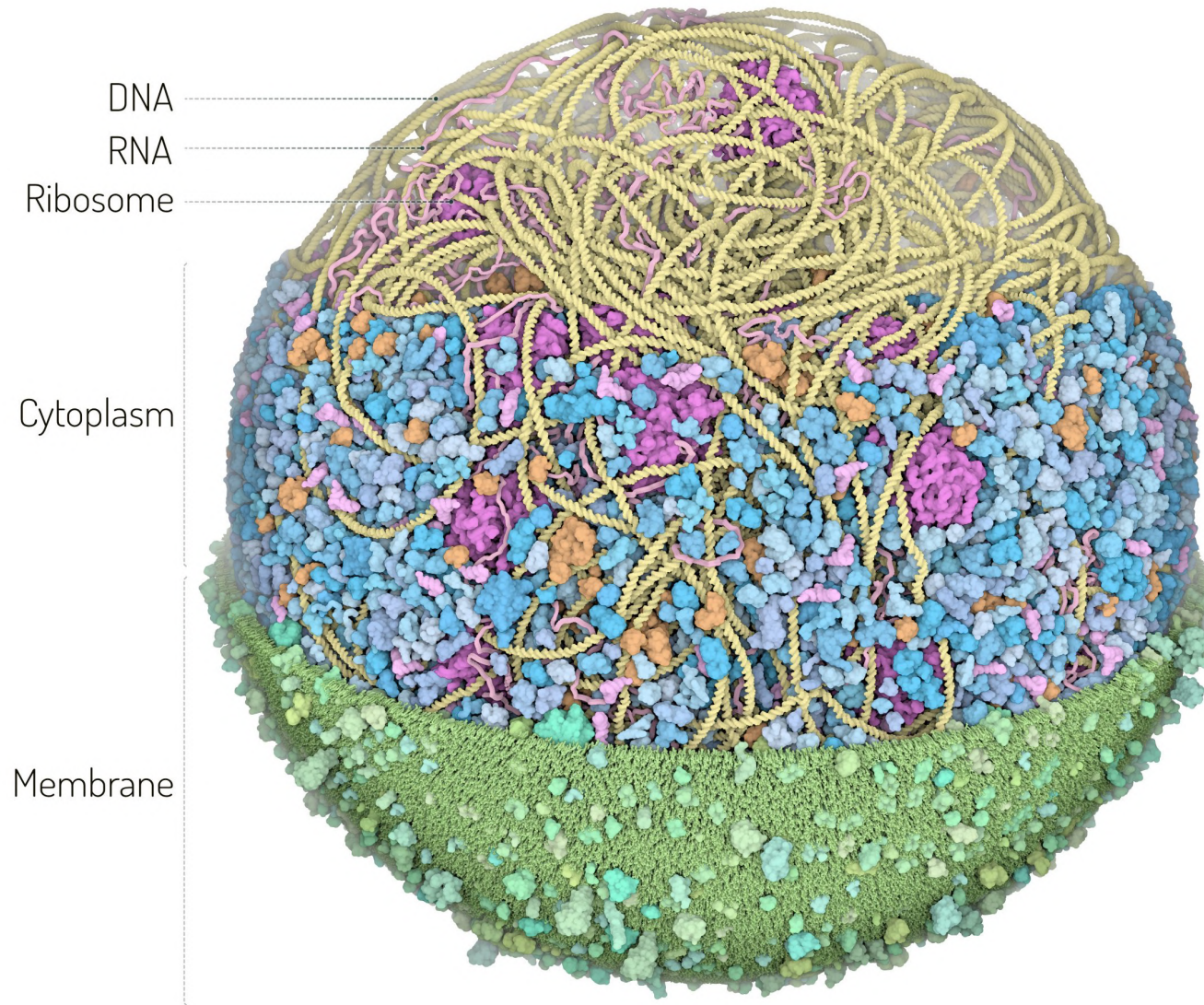
Conditions on Early Earth

Great Oxygenation Event



Holland

Cells are the smallest unit of life



[Image by Martina Maritan, Scripps Research](#)

Mycoplasma genitalium - a bacteria with one of the smallest known genomes.

Cells are the smallest unit of life

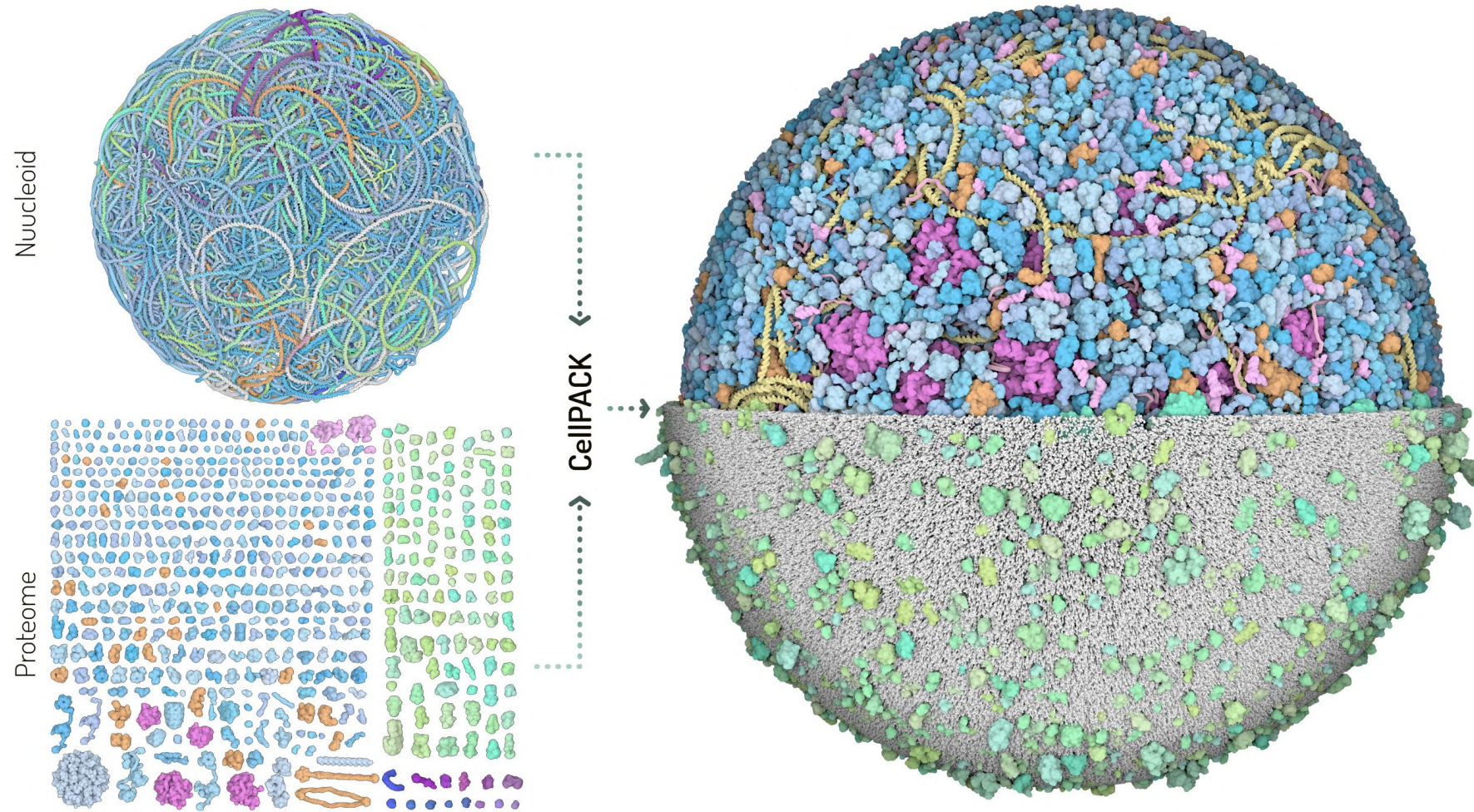


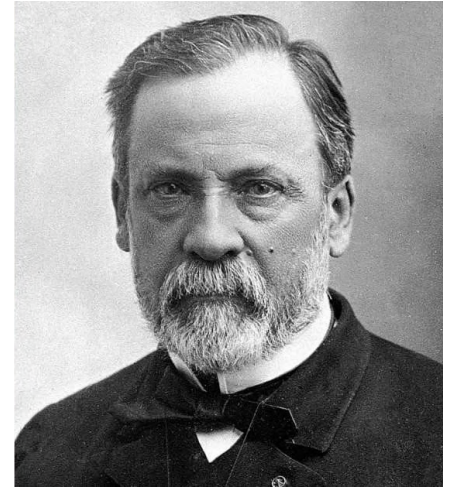
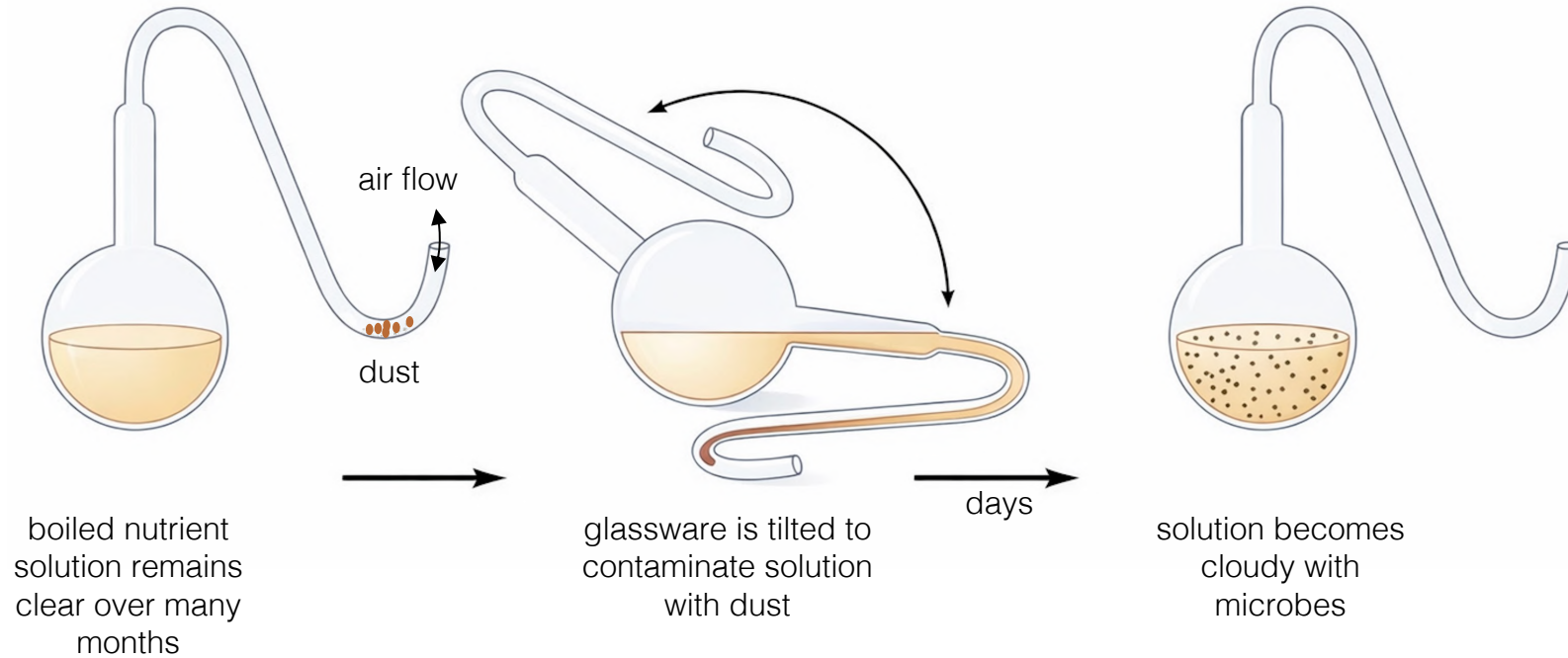
Image by Martina Maritan, Scripps Research

Mycoplasma genitalium a bacteria with one of the smallest known genomes – has about 482 genes / 482 proteins / 580 000 bases of DNA.

It is an obligate parasite requiring a host cell to survive because it has lost much of its genome over time.

Recent estimates suggest LUCA had about 2600 genes / 2600 proteins / 2.5 million bases of DNA.

Challenge of explaining spontaneous origin of cells



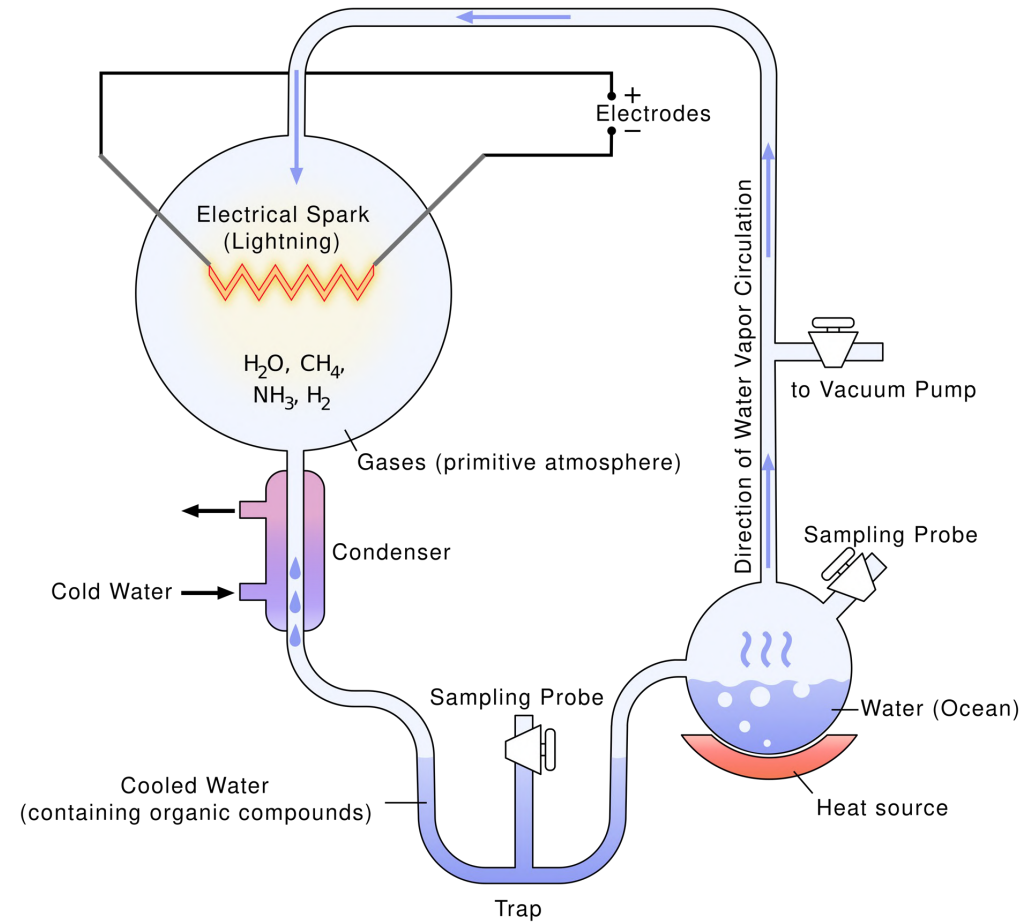
[Britannica](#)

Never will the doctrine of spontaneous generation recover from the mortal blow struck by this simple experiment.

Louis Pasteur

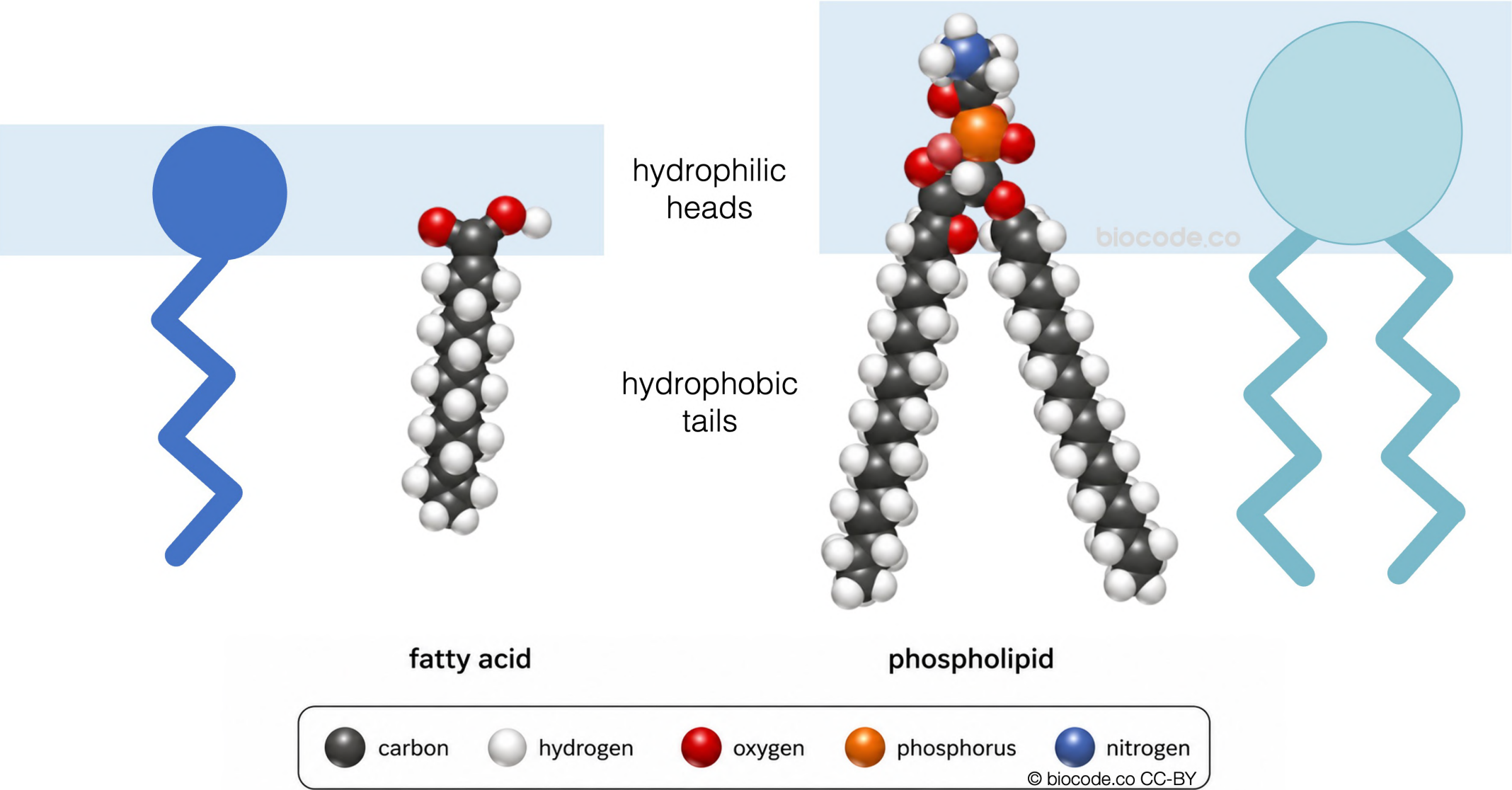
adapted from Pearson 2004

Evidence for the origin of carbon compounds

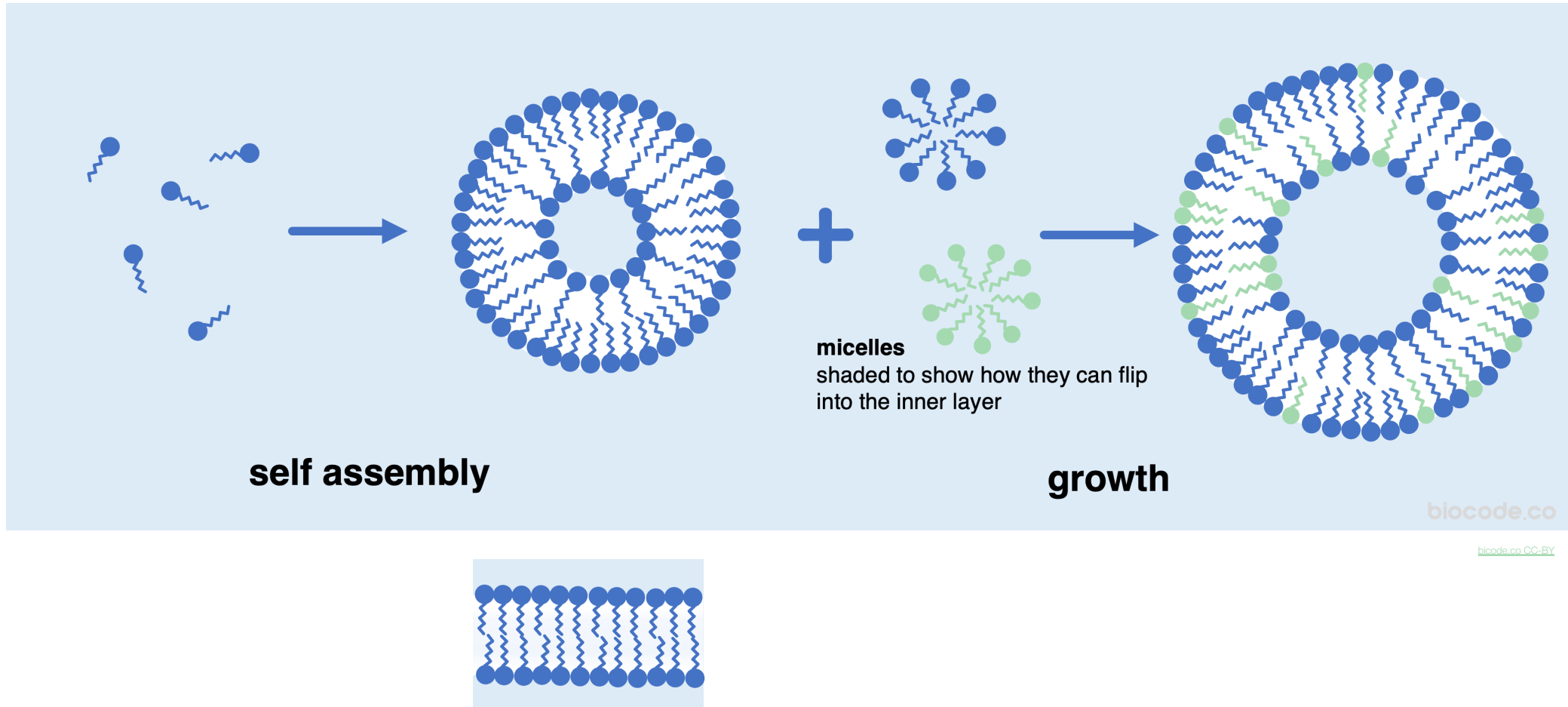


Carry

Spontaneous formation of vesicles



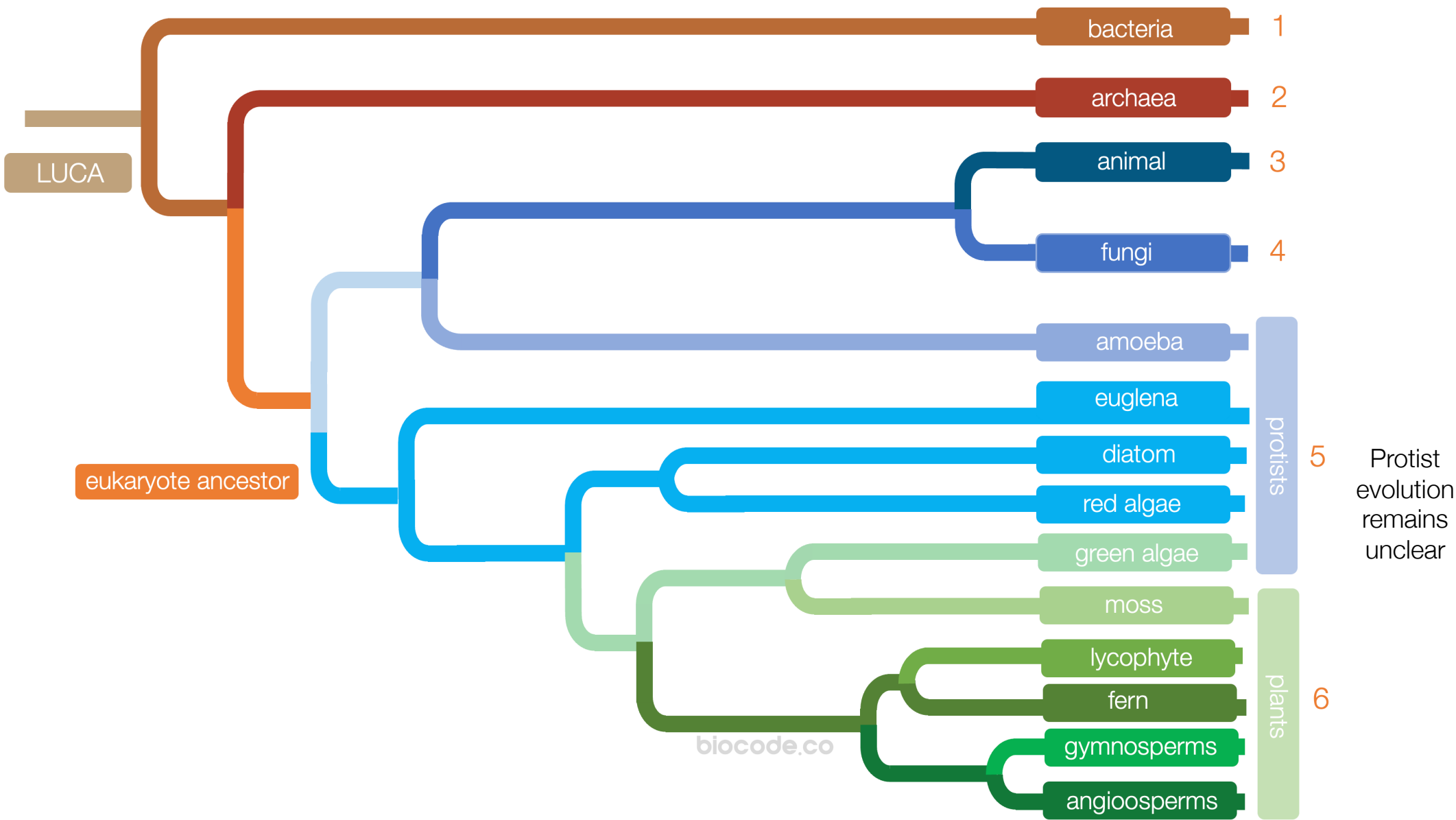
Spontaneous formation of vesicles



Optional Extension Long Story Short challenges to membrane formation by abiogenesis.

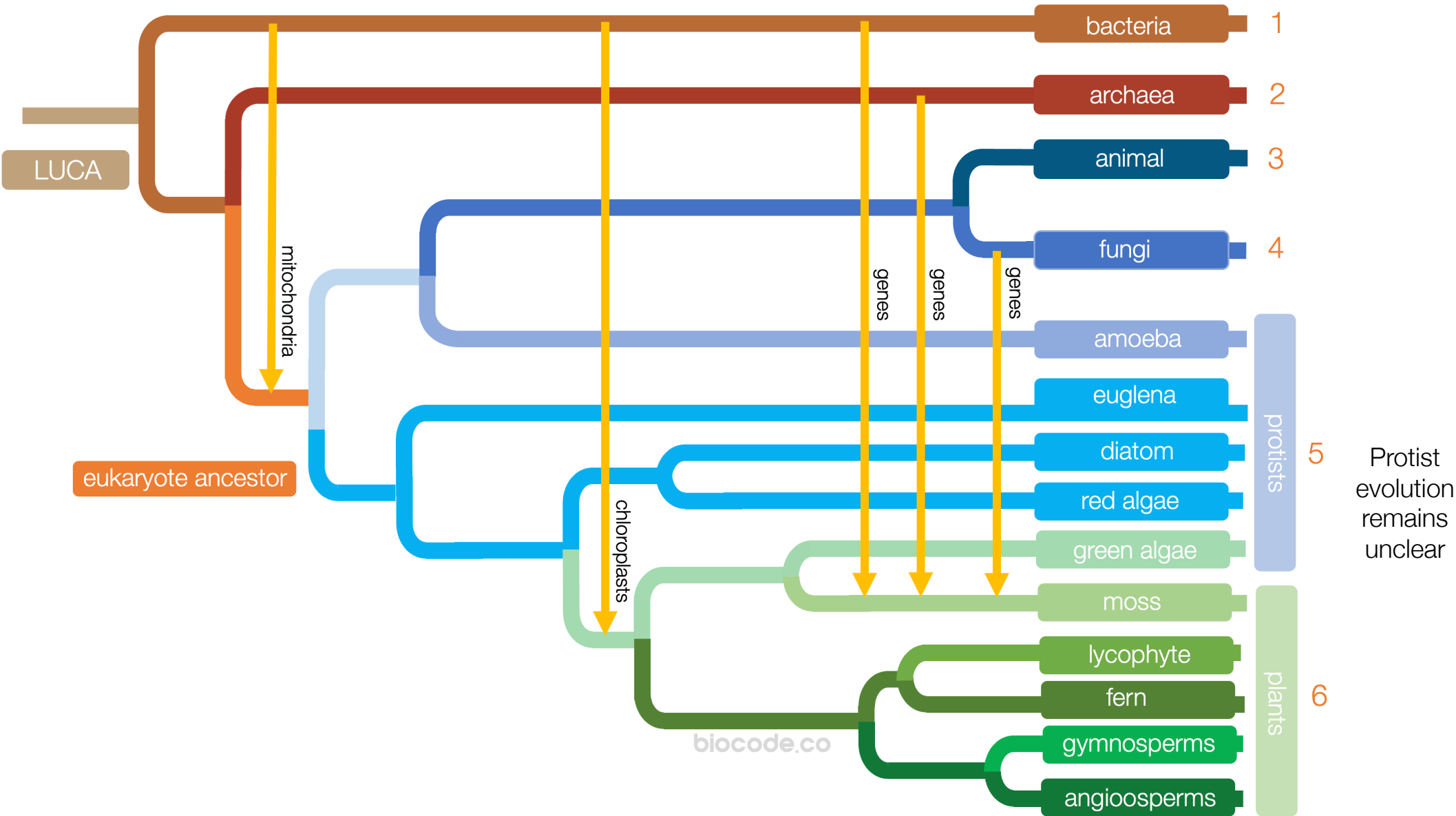
Evidence for LUCA

The Tree of Life Model - Six Kingdoms

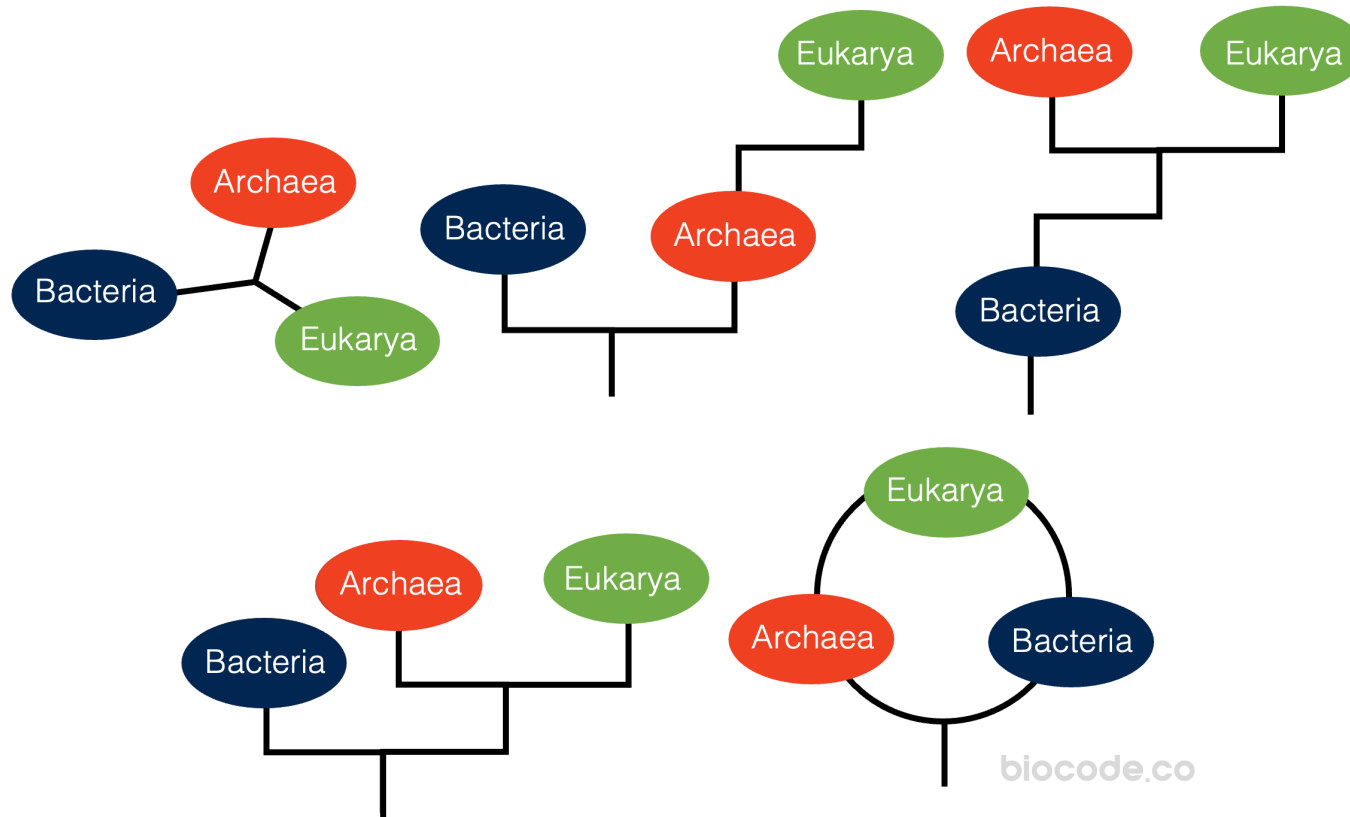


Evidence for LUCA

The Tree of Life Model - Six Kingdoms



Evidence for LUCA



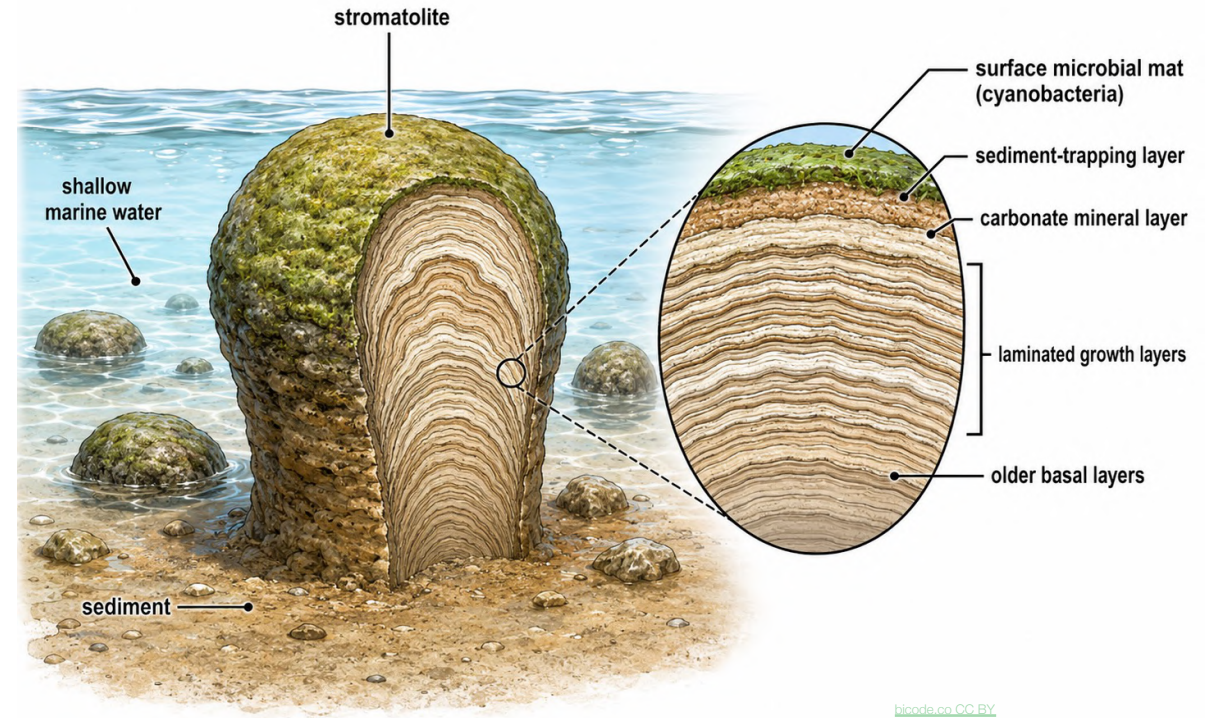
The origin of eukaryotes has a number of possible scenarios.

Estimating Dates for LUCA



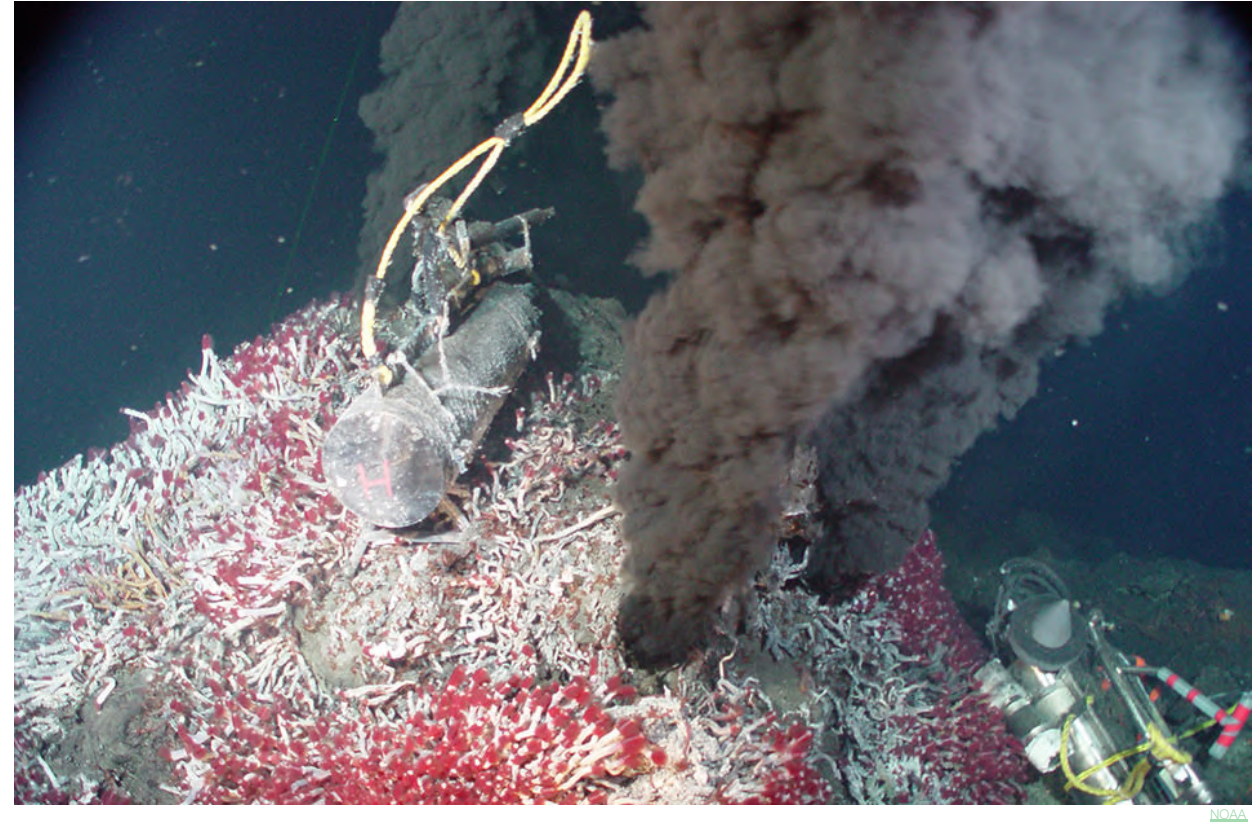
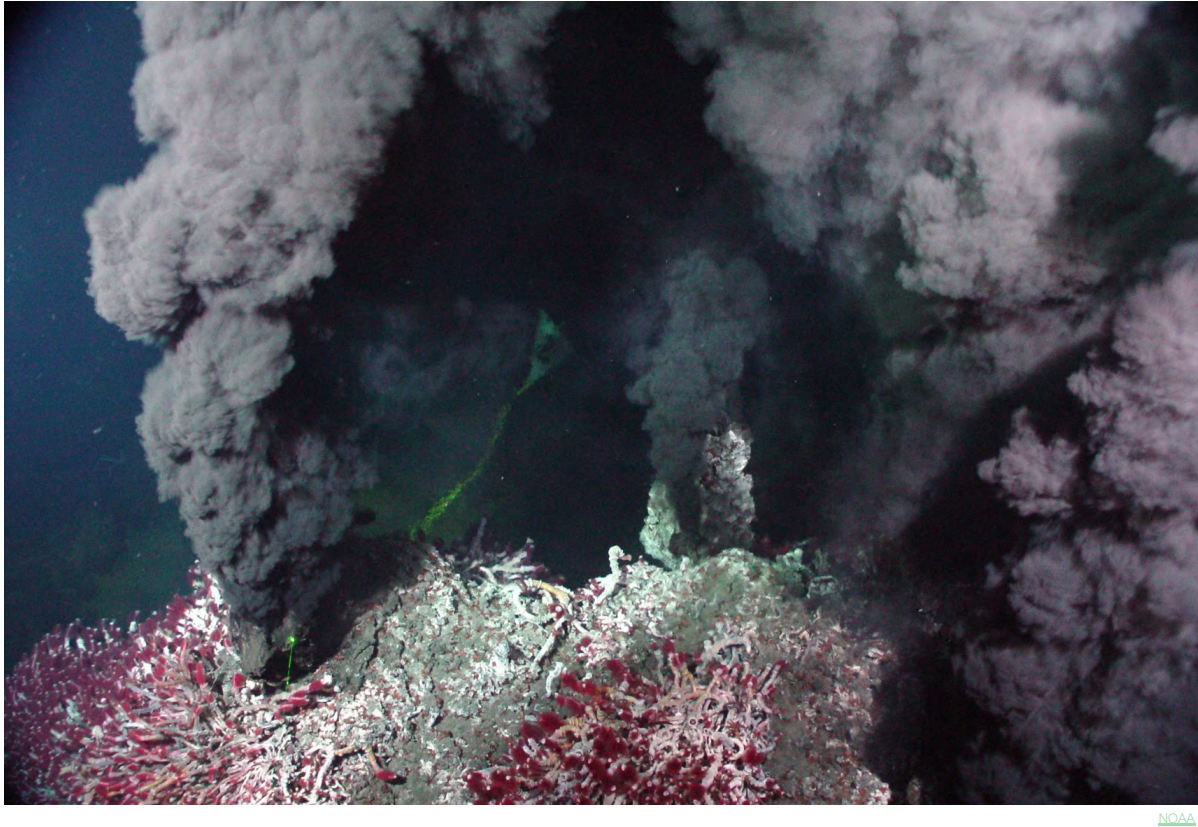
[wikimedia](#)

fossil stromatolite



[biocode.co CC BY](#)

Evidence for LUCA near hydrothermal vents



One hypothesis is that life originated from shallow or deep sea hydrothermal vents. Each hypothesis comes with various possibilities and challenges.

RNA and DNA are clearly too unstable to exist in a hot prebiotic environment.

Stanley Miller and Antonio Lazcano 1995

Optional Extension (not required for IB exams)
SETI



Fort Worth Star-Telegram

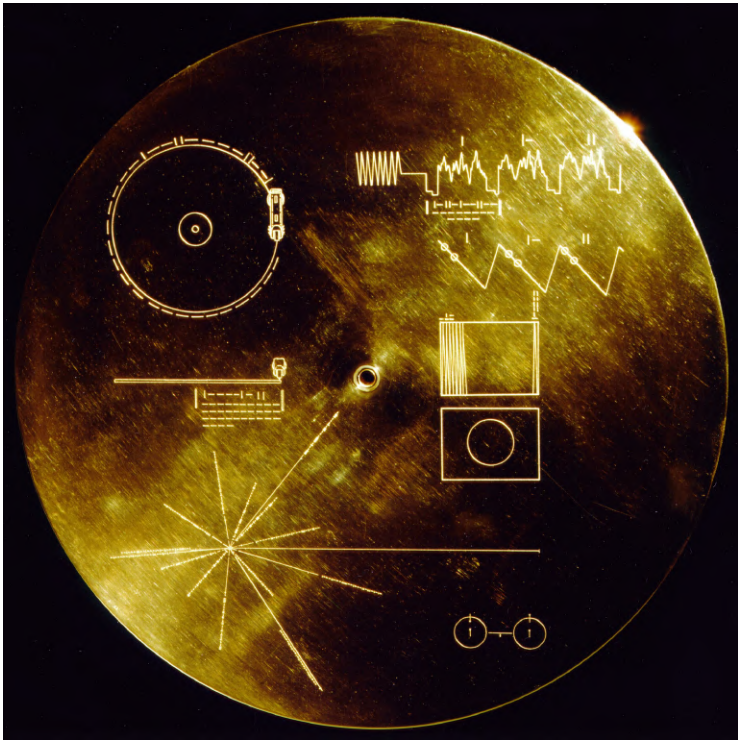
Was life seeded on Earth by aliens?

SETI is the search for extraterrestrial intelligence.

Is detection of intelligence scientifically testable?

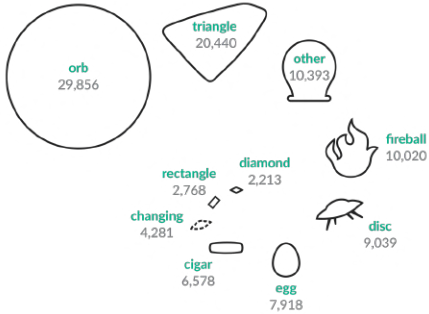
What travel distances are possible for physical beings?

Astrobiology is the study of the origin of life in the universe.



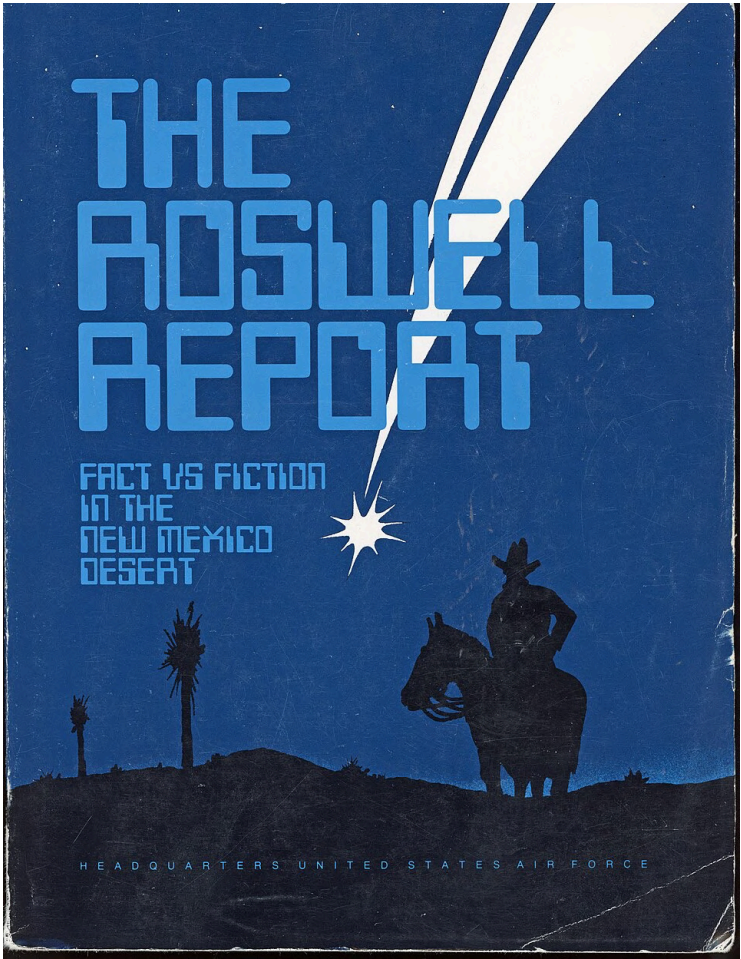
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Contents of The Golden Record



Jones et al

Commonly reported UFO shapes



Weaver and McAndrew

A Christian perspective.

Poem By L. Glen Enloe

*You think you're alone out on the range
Sittin' silent under starry sky,
Just a marvelin' at the universe
And wonderin' 'bout that ol' question: why?*

*You shake your head at worlds of worry,
Knowin' it ain't often that you'll find,
All the answers to your queries
Beneath the clear black sky and pine.*

*You wonder if we rose up from mud
And walked straight and tall upon this earth—
Or was it all created in a moment—
A conception that gave us true birth.*

*Are we all no more than those monkeys
Evolvin' slowly down life's long line?
Or is there more to earth and heaven
Touched by something truly sublime?*

*We keep on punchin' clocks and cattle
And tryin' to get through each new morn—
But is there more to life than dyin'
And will we somehow be reborn?*

*All the cattle know my hard proddin'
As I lead them along time's sad way—
We live for but a flashin' moment,
As we watch life go by in one short day.*

*So make the best of trails you ride, cowboy—
Each tomorrow is both yours and mine—
And gaze long at stars in that vast sky
Placed there by intelligent design.*



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