

# Chapter 4-Evolution + Biodiversity Part I

- Origins of life
- Evolution
  - > Chemical evolution
  - > biological evolution
- Evidence for evolution
  - > Fossils
  - > DNA
- Evolution by Natural Selection
  - > genetic variability and mutation
  - > natural selection
  - > heritability
  - > differential reproduction
  - > adaptation
- Survival of the fittest and fitness

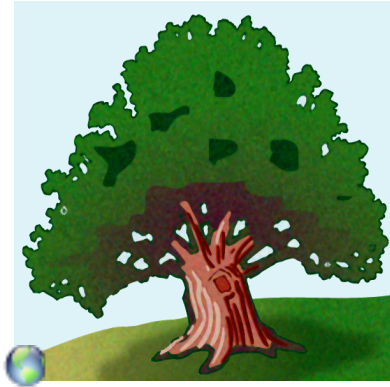
## Part II (Thursday)

Coevolution

Other mechanisms of evolution

Speciation

# Origins of life



From where did life first emerge?

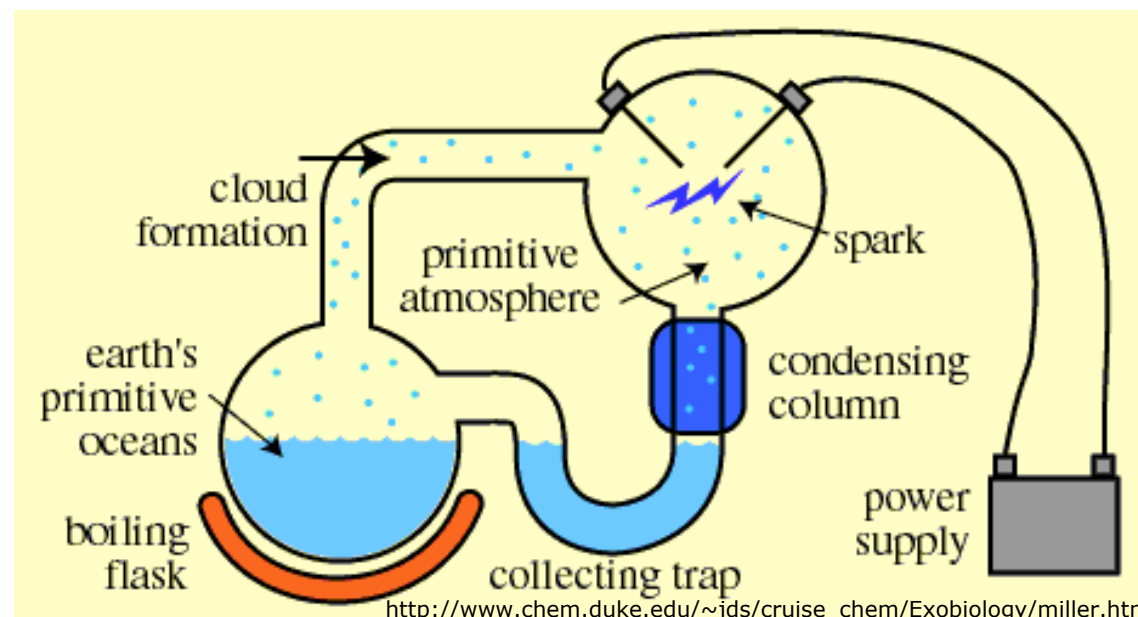
What are the 2 requirements for early life?

- ① genetic material → information
- ② Plasma membrane

# Step 1: Chemical evolution-1 billion years

- organic molecules
- biopolymers
- Cell membrane + genetic material!
- evidence?
  - radioactive elements in rocks and fossils
  - laboratory experiments to replicate earth's early atmosphere and conditions have produced amino acids, sugars, proteins, RNA, and DNA

## Miller and Urey



gasses in primitive atmosphere: methane, ammonia, hydrogen, water

# Part 2: Biological evolution-3.7 billion years

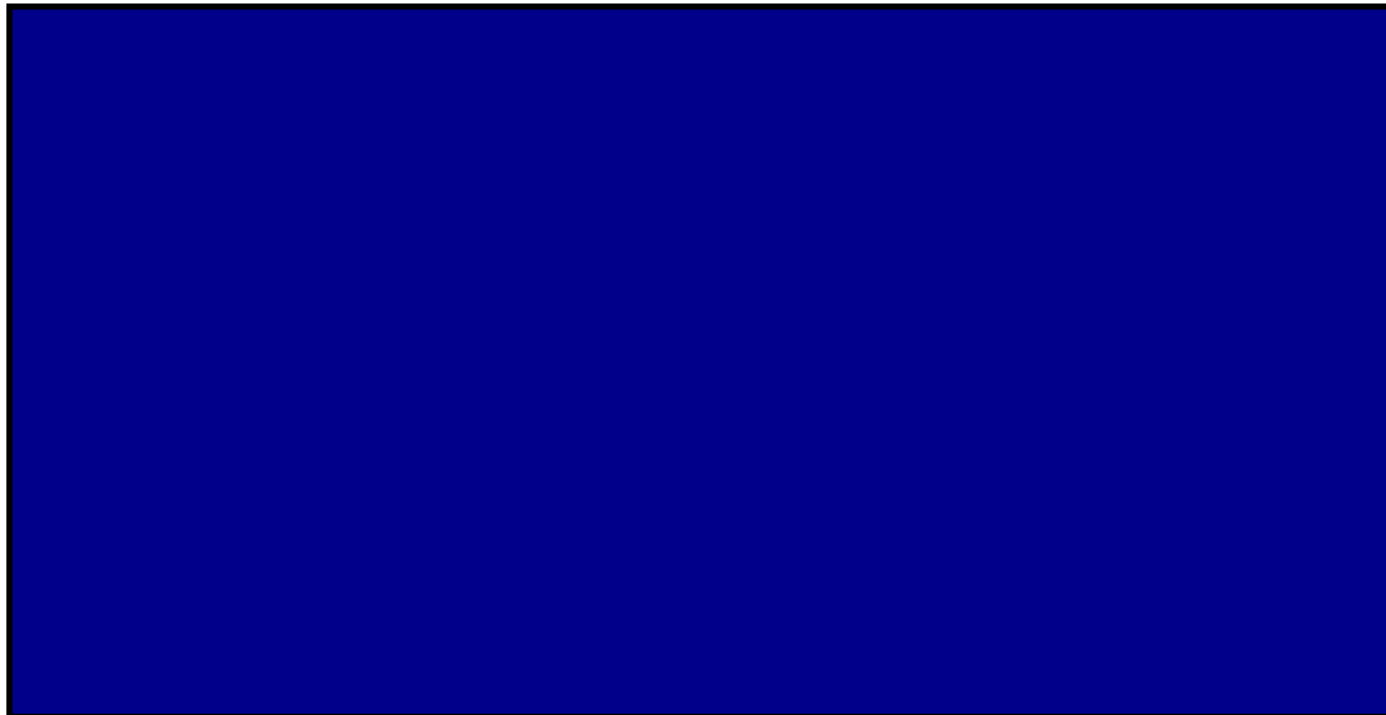
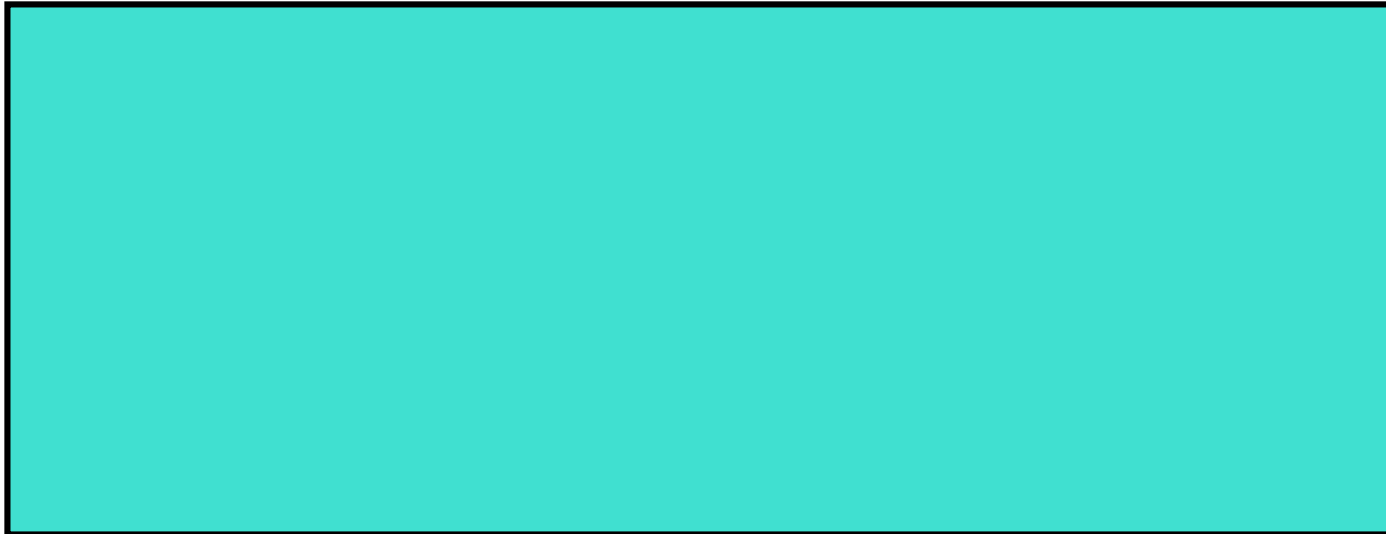
-single-celled prokaryotes-->multicellular organisms (protists, plants, fungi, animals)

-natural selection

# Natural Selection-MBR

# Natural Selection

In order for natural selection to occur, there must be



At what level does natural selection occur?



At what level does evolution occur?



<http://amphibianrescue.org/about/amphibian-rescue-film/>

<http://www.youtube.com/watch?v=LyRA807djLc>





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# Limitations to natural selection

1. Gene pool limits a population's ability to adapt--you can only select from traits you have. You can't create new ones (except by chance through mutation).

2. Reproductive capacity can limit a population's ability to adapt

Organisms that reproduce rapidly (weeds, bacteria, cockroaches, mice) adapt quickly

Organisms that reproduce slowly (humans, whales, tigers) take longer to adapt

# Misconception about Natural Selection

Fitness ~~=~~ strongest

**Fitness** = reproductive success. Ability to produce viable offspring.

Organisms cannot develop traits because they need them or want them.

Genetic variation + natural selection makes adaptive traits more common in a population.

\*\*Evolution = changes in a population's genetic makeup over time

Over time = over generations

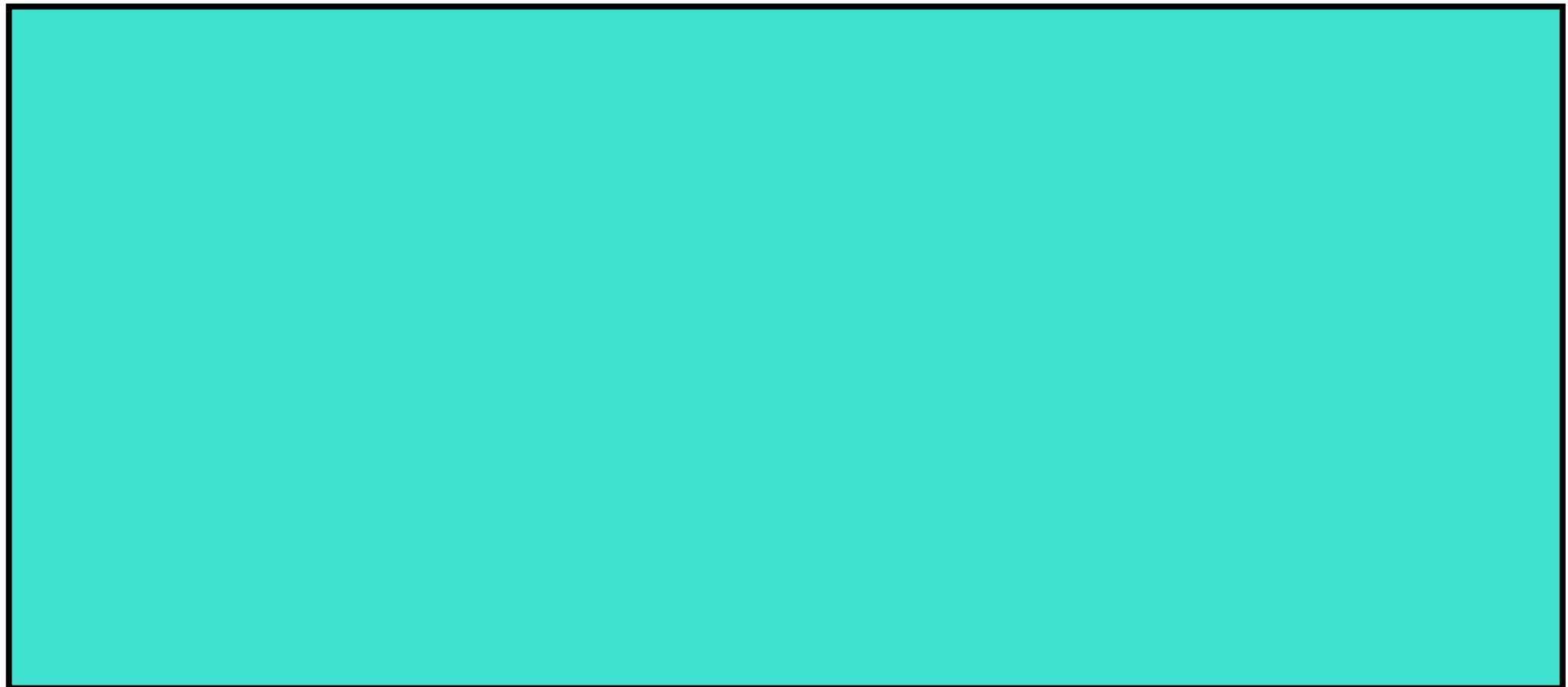
Natural selection is one of the mechanisms for evolution to occur.

The other mechanisms include:

- mutation
- migration
- genetic drift (population bottleneck and founder effect)
- \*Horizontal gene transfer and hybridization

# Coevolution

Textbook: "a biological arms race" between interacting populations of different species.



# Examples of coevolution



Ants and Acacia--hollow thorns, secrete nectar at base for ants. Ants protect acacia against herbivores.

<http://evolution.berkeley.edu/evosite/evo101/IIIFCoevolution.shtml>



Yucca and Yucca moth--The moth lays its eggs in the flower, and the larvae feed on the fruit. The moth pollinates flowers.

This yucca moth is inside the flower of a yucca, *Yucca glauca*. Photo by Ann Cooper, BugGuide.net.

[http://www.fs.fed.us/wildflowers/pollinators/pollinator-of-the-month/yucca\\_moths.shtml](http://www.fs.fed.us/wildflowers/pollinators/pollinator-of-the-month/yucca_moths.shtml)

[http://evolution.berkeley.edu/evosite/evo101/  
index.shtml](http://evolution.berkeley.edu/evosite/evo101/index.shtml)

This is a great website to learn and review topics in evolution.

