

14: Evolutionary History

Key Biology Terms

Angiosperms: Flowering plants. They form seeds inside structures that can protect them from the harsh environmental conditions they might see before fertilization takes place.

Dichotomous key: The entire assemblage of decision points. For example, The taxonomic criteria used to identify a species starting from the animal kingdom point would be considered a dichotomous key.

Dichotomy: Split or decision point in a decision tree or classification system.

Extant: Still in existence.

Gymnosperms: Nonflowering plants with naked seeds such as conifers. Their seeds are not necessarily protected from harsher environmental conditions.

Kingdom Monera: Prokaryotic kingdom

Phylogenetic tree: Depiction of the pattern of evolution or relationship between ancestor and descendant determined by number of shared characteristics in common. Each node =speciation event.

Pre-biotic: Refers to conditions before organic substrates were available

Prokaryote: Bacteria, unicellular.

Protist: The first eukaryotes. Default category for organisms that are eukaryotic but do not fit into the other 3 kingdoms

Proto-life: A term intended to label pre-life, that is the immediate precursor before life began

RNA: A polymer consisting of ribonucleic acid monomers. It is capable of selfl replication, catalytic action and in the case of RNA viruses, can store genetic information

Speciation Event: Members of an established species thru evolutionary process, form new species.

Spontaneous animation: Life from non-life. Impossible under current atmospheric conditions. Theoretically possible under early earth atmosphere.

Taxonomic Categories: Kingdom, Phylum, Class, Order, Family, Genus, Species. Useful pnemonic = "King Philip Came Over For Good Supper".

Darwin and the Origin of Life

Darwin discussed "Origin of Species". he was unsure about Origin of Life because of paucity of fossil evidence

- ❶ Fossils undetected for first ~ 3.8 – 4 billion years of evolutionary history.
- ❷ Search for such fossils ≥ century since Darwin's time
- ❸ Evidence of earliest life via fossil record may not be possible?

Ability of fossils to record history limited:

- ❶ Organisms with exo / endoskeletons favor fossilization those without → less likely to be fossilized and found
- ❷ Organisms with cell membranes but without cell walls (for example mycoplasma today) may not fossilize.
- ❸ Therefore, likely need new methods of detecting earliest forms of life.

Basic Sequence → Proto-Life & RNA

- 1.) Organic compounds → polymers of repeating units
- 2.) Lipids & others can and do organize into spheres based on inherent properties.
- 3.) Lipid spheres can encapsulate organic molecules
- 4.) Encapsulated organic molecules such as RNA can self-replicate, are autocatalytic, can act as rudimentary templates for protein synthesis

Compete for scarce resources such as RNA monomers
Competition → natural selection of "fittest" RNA molecule → reproduction of that RNA molecule.

Endosymbiosis

Endosymbiotic hypothesis: Attempts to account for the major evolutionary leap between prokaryotes and protists, the first eukaryotes.

- ❶ In a nutshell, hypothesis proposes a larger prokaryote ingested a smaller prokaryote → organelles such as mitochondria and chloroplasts

Paedogenesis

Paedogenesis: Larvae reaches reproductive maturity before reaching adulthood→ maintenance of larval life cycle and morphology → major change in body plan.

- ❶ Hypothesis: paedogenesis of early larval chordates → maintenance of motile organism with chordate features → subsequent selection pressures favored
- ❷ Selective pressures acting on paedogenic larval urochordates → modifications of chordate traits that did not exist in mature adult

Other Events → Major Morphologic Changes

Extinction events:

- ❶ There have been several in the triassic period alone, not the least of which being the dinosaur extinction.
- ❷ Some estimate that 90% of all animal species were lost during this time period.

--What caused this extinction is still up for debate
 ---Some say a mega asteroid hit he earth creating a dust cloud that led to a global shift in the climate.

- ❶ Also land mass shifts→ major morphologic changes.

Animal Phylogeny

