

# General Biology 2: Lecture 3

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13 September 2023

- History of Life
  - Adaptive Radiation
    - \* Post-Mass Extinction
    - \* Surviving species quickly diversify
  - Precambrian Time
    - \* Hadean, Archaean, Proterozoic Eons
      - Little to no atmospheric oxygen
      - Lack of ozone shield allowed radiation to bombard Earth
      - First cells come into existence in aquatic environments
      - Prokaryotes (3.5 billion years ago)
        - Cyanobacteria left many ancient stromatolite fossils
        - Cyanobacteria added first oxygen to the atmosphere
      - Evolution of abiotic species
      - Eukaryotes (2.5 billion years ago) - (Endosymbiotic Hypothesis: eukaryotes evolved from prokaryotes)
      - Multicellularity Arises (1.5 billion years ago)
      - Glycolysis as first aerobic process
      - Union of bacteria and archaea potentially led to the first Eukaryotic cell (membranes)
      - Ediacaran Fossils (end of Proterozoic) 600-540 million years ago
        - Multicellular animals appear including sponges
        - Shallow marine mudflat animals, unusual forms, no internal organs, no shell or bones (all invertebrates)

Possessed collagen (all animals have the collagen protein)  
Ended with a Mass Extinction event  
Cylindrical / segmented fossils from Ediacaran period show signs of animals being more elaborate, but most fossils are not discovered

– Phanerozoic Eon

- \* Paleozoic Era (“Ancient Life”) 540-248 million years ago
  - Cambrian Explosion
    - Warm, wet climate,  $O_2$ , no ice at poles
    - All existing phyla appear in the fossil record
    - No new animal body plans have developed since the Cambrian Explosion
    - Many marine invertebrates with shells
    - First vertebrates (520 million years ago)
  - High diversity of the Cambrian due to:
    - Favorable environment - Oxygen, (Calcium Carbonate for shells)
    - Evolution of Hox genes (regulatory genes)
    - Predator/prey “Arms Race” - shells, reef-building
  - Burgess Shale organisms
    - British Columbia, Canada
    - Rapid burying of animals in mudslide led to rapid fossilization of many species
    - Continuous new discoveries e.g. massive new species of arthropod (radiodonts)
  - Ordovician Period (490-443 million years ago)
    - Warm temperatures and atmosphere very moist, lots of  $CO_2$  in atmosphere
    - Diverse marine invertebrates: trilobites, brachiopods, bryozoans, etc.
    - Primitive plants and arthropods first invade land
    - First vertebrates (fish-like)
    - Abrupt climate change (glaciers) led to mass extinction
  - Silurian Period (443-417 million years ago)
    - Stable climate, glaciers melted, sea levels rose
    - Significant vertebrates (fish), plants, coral reefs

Large colonization by terrestrial plants (seedless) and arthropods

- Devonian Period (417-354 million years ago)

“Age of Fishes”

Rapid diversification of fishes

North is dry, south is wet (oceans)

Jawed and unjawed fishes gain dominance of cephalopods

- Carboniferous Period (354-290 million years ago)

Rich coal deposits formed from plant material

Cooler with land covered by forests and swamps

Plants and animals further diversified

Very large plants and trees present

Flying Insects

Animals developed in isolation tend to be bigger

Amphibians prevalent

Amniotic egg evolved in reptiles (leathery egg shell)

Amphibians lay eggs in water, reptiles eggs protected by a shell and can be layed on land, provides internal fluid for embryo

- Permian Period (290-248 million years ago)

Continental drift formed supercontinent Pangaea

Forest shift to gymnosperms (conifers)

Amphibians prevalent, but reptiles begin to dominate

First mammal-like animals appeared // Ended with the largest known mass extinction event (“The Great Dying”)

\* Mesozoic Era (“Middle Life”) 248-65 million years ago