

EVOLUTION OF MULTICELLULAR LIFE

Big Picture

This is a *very* brief description of how the organisms that we have today evolved from the early, single-celled organisms that lived in water two billion years ago. We must remember that it took an extremely long period of time for the modern-day organisms to appear and that there were many more organisms that today's organisms evolved from. These species were forced to adapt to Earth's constantly changing environment.

Key Terms

Geologic Time Scale: Divides the history of the Earth into different time periods based on the climate and the types of organisms living on Earth at the time.

Mass Extinction: When some sort of geologic or climate change causes a large number of species to go extinct.

Extinction: When all organisms of a particular species die; this can be a result of some natural phenomenon, such as a meteor falling.

Important Eras

The **geologic time scale** organizes Earth's history by major changes in geology and climate and by important events in the evolution of life. These are some of the key eras organized in chronological order:

Late Precambrian Era:

Occurred two billion years ago to about half a billion years ago.

There were a lot of geologic and climate changes to the Earth.

- The continents drifted away and toward one another, eventually forming the continents we have now.
- There were also fluctuating carbon dioxide levels due to volcanic activity. This caused the climate to change constantly, as the Earth was continually going in and out of ice ages. One ice age was so cold, the Earth was completely covered with snow and ice and was called "snowball Earth."

About a billion years ago, the first multicellular organisms evolved.

- Single-celled organisms often found it beneficial to live close to one another in colonies and to perform different and specialized tasks. Over time, these formerly independent single-celled organisms became dependent on one another and thus the colonies of single-celled organisms became multicellular organisms.

This era ended half a billion years ago with a **mass extinction**, due to some geologic or climate change. Even though we don't know the real cause of this mass extinction, we do know that this mass extinction paved the way for a lot of new species to form in the next era: the Paleozoic Era.

Cambrian Explosion:

The extreme burst of life that occurred right before the Paleozoic Era. This happened as a result of the mass extinction that occurred at the end of the Precambrian era. When the surviving species no longer have as much competition as it did before, it is allowed to thrive and adapt in its own way.

Paleozoic Era:

Occurred around 544-245 million years ago; so much happened in this era that it had to be divided into 6 periods

- Cambrian Period: Because the preceding era ended with a mass extinction, this period began with a huge explosion of new organisms. Ancient organisms such as sponges and trilobites formed.
- Ordovician Period: Although no animals lived on land (all animals were invertebrates that still lived in water), plants such as mosses started appearing on land, and the earliest fish started appearing.
- Silurian Period: Fish and coral continued to live in the oceans, and vascular plants, such as ferns, evolved on land.
- Devonian Period: A type of fish evolved to breathe oxygen when its head was above water. Moreover, seed plants, or gymnosperms, evolved on land.
- Carboniferous Period: The large plants on land created a huge amount of carbon that later became coal. Amphibians left the oceans and were able to dwell on land but could not reproduce. Only towards the end of this period were amphibians able to reproduce on land as well.
- Permian Period: Pangaea, a huge landmass, formed when all the landmasses on Earth meet each other. In this period, the climate was very dry, forcing plants and animals to evolve adaptations. Plants had waxy leaves and animals had leathery skin to prevent water loss.



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Permian Extinction:

This was a mass extinction at the end of the Permian Period, marking the end of the Paleozoic Era.

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Important Eras (cont.)

Mesozoic Era:

Occurred around 245-65 million years ago; known as the age of dinosaurs, the era was divided into three main periods.

- Triassic Period: Pangaea began drifting apart, and dinosaurs branched away from the amphibians. Corals, fish, and insects evolved, and the dominating plants on land were ferns and conifers. Eventually, there was a huge extinction by the end of this period.
- Jurassic Period: Because a lot of competition between various organisms disappeared with the mass extinction, dinosaurs were able to flourish in this period. Eventually, birds evolved from the dinosaurs. The continents continued to move away from each other, and flowering plants evolved.
- Cretaceous Period: The dinosaurs reached their largest sizes, but by the end of this period, there was some sort of meteor/asteroid that contributed to the extinction of these dinosaurs. At this time, the continents drifted essentially to the same place they are currently located today.

Cenozoic Era:

Occurred around 65 million years ago and still continues today; this is the era during which mammals appeared and flourished and is divided into two periods

- Tertiary Period: Primates (including human ancestors) evolved, and flowering plants and rainforests flourished.
- Quaternary Period: The climate cooled down considerably, causing ice ages and forcing organisms to move closer to the equator where it was warmer or go extinct.

There has been five mass extinctions in Earth's history. This is not a bad thing, as this sudden change in species can allow the surviving species to flourish with less competition.

How did multicellular organisms evolve?

Single-celled organisms often found it beneficial to live close to one another in colonies and perform different and specialized tasks. Over time, these formerly independent single-celled organisms became dependent on one another and thus the colonies of single-celled organisms became multicellular organisms.

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