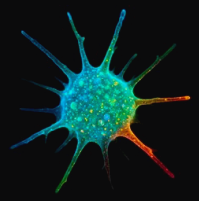
Genes.media / DEEP TIME · SAPIENS

Teaching pack

An introduction to Deep Time and Sapiens, two interactive timelines, for teachers, students and other users, and for the readers of any website that shares them. This pack is offered as content that anyone sharing the timelines may use.



What is Deep Time?

Deep Time is a way to navigate the history of our planet and of life. It takes the form of an interactive timeline that spans 4.54 billion years and keeps pace with new scientific publications. Each dated event sums up the scientific consensus as it stands: a measurement or a line of reasoning that named researchers have published in peer-reviewed journals. This consensus may be revised.

Where a traditional timeline gives a single date, each date in Deep Time also comes with its degree of certainty (precise, approximate, within a range or debated) and the publications it rests on. When estimates diverge, a note explains the disagreement.

The scale of the interactive timeline is linear at every zoom level: distances on screen are proportional to durations. At a glance, one can see how the 66 million years since the end of the dinosaurs compare with the 4.54 billion years of the Earth's history.

Events in the planet's history are discovered as users explore. Many are linked by causal arcs to the events that contributed to them. The aim is to let users lose themselves in the timeline and have an experience akin to exploration. The Sapiens timeline takes users through the 300,000 years of our species in the same way.

This presentation text may be reused as it stands, in full or in part.

For a specific topic

An entry is the text, usually accompanied by an image, that appears on the right of the screen when an event on the timeline is clicked. It also exists as a separate full-screen page with its own address: a link to that page takes students straight to the event, with no need to click on the timeline. Links to the entries' pages are given further on in this document, theme by theme. For example:

> To place the Great Oxidation Event in the history of the Earth: its entry on Deep Time, an interactive timeline, with its date and its sources.
> genes.media/deep-time/en/event/great-oxidation-event/

Useful addresses

DEEP TIME

The timeline
genes.media/deep-time/en/timeline/

The 200 entries
genes.media/deep-time/en/events/

The geologic time scale
genes.media/deep-time/en/geologic-time-scale/

The history of Earth
genes.media/deep-time/en/history-of-earth/

The history of life
genes.media/deep-time/en/history-of-life/

The major transitions in evolution
genes.media/deep-time/en/major-transitions-in-evolution/

SAPIENS

The timeline
genes.media/sapiens/en/timeline/

The 200 entries
genes.media/sapiens/en/events/

The timeline from prehistory to today
genes.media/sapiens/en/prehistory/

The chronology of *Homo sapiens*
genes.media/sapiens/en/chronology-of-homo-sapiens/

MATERIALS AND METHODS

How the two timelines were built
genes.media/deep-time/en/methods/

The entries, theme by theme

In each theme, events run from the oldest to the most recent. Each title is a link to the entry's page.

THE AGE OF THE EARTH AND THE MEASUREMENT OF TIME · DEEP TIME

The Formation of the Earth
~4.54 billion years ago

The Jack Hills Zircons
~4.4 billion years ago

The Acasta Gneiss: Oldest Rock
~4.03 billion years ago (older claims to 4.3 Ga)

James Hutton and Deep Time
1788 CE

Naming the Geological Periods
1815 to today

Radiocarbon Dating
1949 CE

The Age of the Earth
1956 CE

THE EARTH'S ATMOSPHERE AND LIFE · DEEP TIME

Earth's First Atmosphere
~4.45 to 4.3 billion years ago

The Proof of an Oxygen-Free Atmosphere
~3.5 to 2.4 billion years ago

Banded Iron Formations
~3.5 to 1.8 billion years ago

The Oldest Reef: Built by Microbes
~3.43 billion years ago

Oxygenic Photosynthesis
~3.2–2.8 billion years ago

The Great Oxidation Event
~2.4 billion years ago

The End of Banded Iron
~1.85 billion years ago

The Ozone Layer Forms
~430 million years ago

THE HISTORY OF LIFE · DEEP TIME

LUCA: the Last Universal Ancestor
~4.2 billion years ago (estimates 4.3 to 3.5 Ga)

The Oldest Traces of Life
~3.7 billion years ago (claims 3.95–3.5 Ga)

The First Eukaryotes
~2.0–1.8 billion years ago

The Ediacara Biota
~575 to 539 million years ago

The Cambrian Explosion
~540–518 million years ago

The First Land Plants
~470 million years ago

The First Tetrapods on Land
~390 million years ago

Archaeopteryx and the First Birds
~150 million years ago

The Rise of the Mammals
~66 to 56 million years ago

BIOLOGICAL CRISES · DEEP TIME

The End-Ordovician Extinction
~445 million years ago

The Late Devonian Extinctions
~372 to 359 million years ago

The Great Dying: Permian Extinction
~252 million years ago

The End-Triassic Extinction
~201 million years ago

The Deccan Traps
~66 million years ago

Chicxulub and the End of the Dinosaurs
66.0 million years ago

The Sixth Extinction
since about 1900 CE

PAST CLIMATES · DEEP TIME

The Huronian Glaciations
~2.45 to 2.22 billion years ago

Snowball Earth
~717 to 635 million years ago

The Late Palaeozoic Ice Age
~360 to 260 million years ago

The Cretaceous Thermal Maximum
~94 to 83 million years ago

The Palaeocene-Eocene Thermal Maximum
~56 million years ago

The Freezing of Antarctica
~34 million years ago

The Quaternary Ice Ages
~2.6 million to 11,700 years ago

The Younger Dryas
~12,900 to 11,700 years ago

The Keeling Curve
1958 to 2016 CE

The EPICA Dome C Ice Core
2004 CE

THE EARTH IN MOTION · DEEP TIME

The Start of Plate Tectonics
~3 billion years ago (estimates 3.8 to 2.2 Ga)

The Supercontinent Rodinia
~1.1 billion to 700 million years ago

Pangaea
~335 to 175 million years ago

The Break-Up of Pangaea
~201 to 135 million years ago

The Messinian Salinity Crisis
~5.96 to 5.33 million years ago

The Isthmus of Panama Closes
~2.8 million years ago (contested)

Seafloor Spreading and Magnetic Stripes
1963 to 1968 CE

HUMAN EVOLUTION · DEEP TIME

Sahelanthropus: the First Hominin
~7 million years ago

Laetoli and the Origin of Bipedalism
~3.7 to 3.2 million years ago

Lomekwi: the Oldest Stone Tools
~3.3 million years ago

The Oldest *Homo* Fossil
~2.8 million years ago

Dmanisi: the First Departure
~2.1 to 1.8 million years ago

The Control of Fire
~1 million years ago (habitual use by ~400,000 years ago)

Neanderthals
~430,000 to 40,000 years ago

The Origin of *Homo sapiens*
~300,000 years ago

The Denisovans
~300,000 to 50,000 years ago

Out of Africa
~60,000 years ago

PREHISTORY AND THE FIRST SOCIETIES · SAPIENS

Jebel Irhoud: Oldest *Homo sapiens*
~315,000 years ago

Out of Africa
~70,000–50,000 years ago

Neanderthal Admixture in Our DNA
~50,500 to 43,500 years ago

Chauvet Cave: Aurignacian Art
~37,000–33,500 years ago

Lascaux Cave
~21,000 years ago

The Neolithic Revolution
~11,500 years ago

Gobekli Tepe: a Temple Before Farming
~11,500 years ago

Catalhoyuk: a Neolithic Town
~9,100 years ago

Uruk: the First City
~3500 BCE

The Invention of Writing
~5,200 years ago

THE HISTORY OF SCIENCE · DEEP TIME

James Hutton and Deep Time
1788 CE

The First Vaccine
1796 CE

Darwin: Descent with Modification
1859 CE

Mendel's Rules of Inheritance
1866 CE

The Chromosome Theory of Inheritance
1902 to 1915 CE

The Discovery of Penicillin
1928 to 1945 CE

Avery and the Role of DNA
1944 to 1952 CE

Radiocarbon Dating
1949 CE

The Structure of DNA
1953 CE

The Age of the Earth
1956 CE

The Molecular Clock
1962 to 1965 CE

Seafloor Spreading and Magnetic Stripes
1963 to 1968 CE

The Iridium Layer at the K-Pg Boundary
1980 CE

The Polymerase Chain Reaction
1983 to 1985 CE

Ancient DNA
1984 to 2010 CE

CRISPR Genome Editing
2012 CE

Four ideas for activities

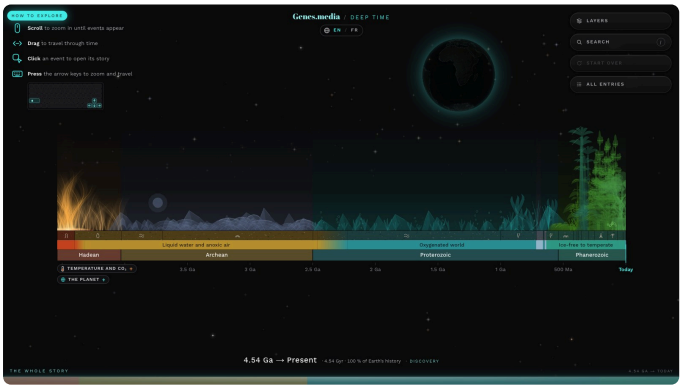
1. **Estimate, then check**
   On a strip of paper 4.54 metres long, where one metre stands for one billion years, students place seven events: the formation of the Earth, the oldest traces of life, the Great Oxidation Event (the build-up of oxygen in the air), the Cambrian explosion (the rapid appearance of most of the major groups of animals), the first tetrapods (four-limbed vertebrates) on land, the impact of the Chicxulub asteroid, at the time the dinosaurs disappeared, and the appearance of *Homo sapiens*. They then look the events up on Deep Time and measure the gap between their estimate and the date given in the entry. On the strip, the Chicxulub impact falls 6.6 centimetres from the present, and the appearance of *Homo sapiens* 0.3 millimetres from it.

2. **Debate a contested trace of life**
   The entry “The Oldest Traces of Life” gives “~3.7 billion years ago (claims 3.95–3.5 Ga)”, where Ga means a billion years. Below the date, a note explains why the biological origin of these traces is contested. Students list the proposed ages and the publications that put forward each one, and look for the arguments that would make a trace of life convincing.

3. **Follow a chain of causes**
   On the timeline, clicking the Great Oxidation Event opens its entry and draws causal arcs: they link the event to those that contributed to it, such as the appearance of the photosynthesis that releases oxygen, and to those it contributed to. Hovering over an arc brings up a sentence that explains the connection. Students read these sentences, then write down the chain that leads from photosynthesis to the oxygen in the air.

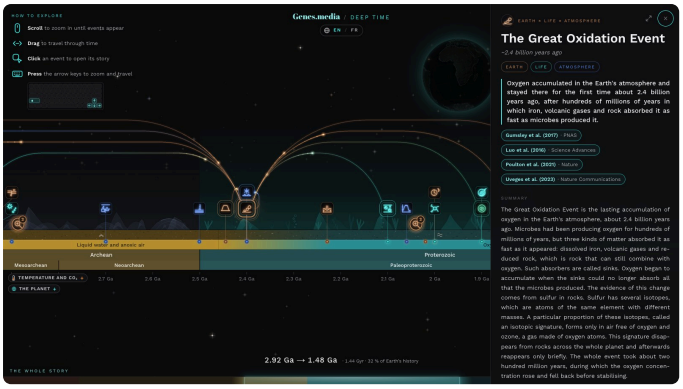
4. **Compare durations**
   Below the timeline, a line gives the time interval on screen, its duration and the share of the Earth’s history that it represents. Students zoom in on the Phanerozoic, the most recent of the four great divisions of geological time, whose name means “visible life”, and see that it covers the last 12 per cent of the Earth’s history.

Screenshots

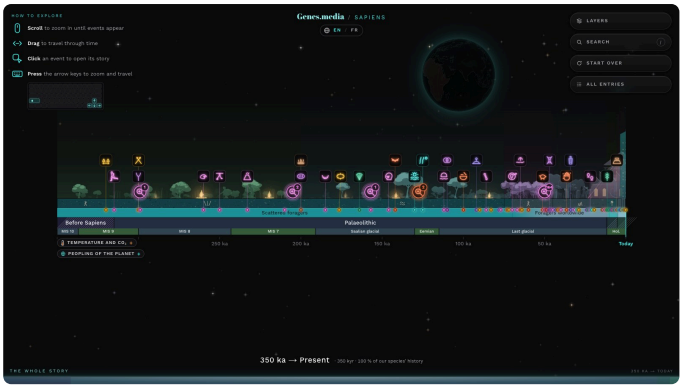


Deep Time as it opens, from the formation of the Earth to the present day.

Deep Time showing the last 714 million years. Trilobite silhouette: Sam Gon III, PhyloPic image bank, CC BY 4.0 licence.



The Great Oxidation Event entry, with the arcs that link it to earlier and later events.

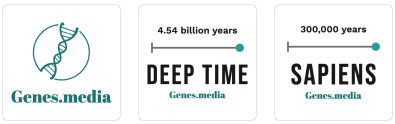


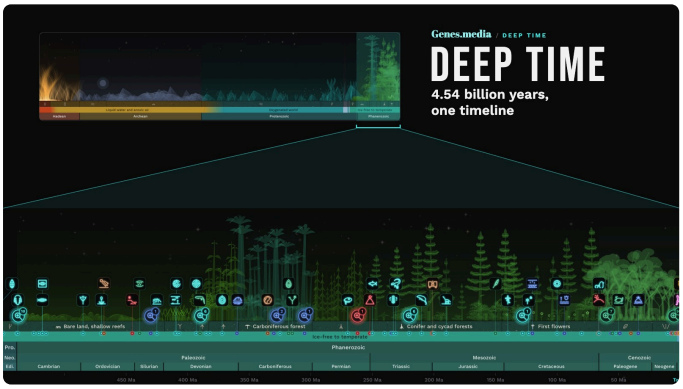
Sapiens with all its events displayed, from 350,000 years ago to the present day.

These screenshots, like any screenshot of the two timelines, may be reused in teaching materials, with a mention of Genes.media and of the address of the page shown. With the second one, also credit the author of the trilobite silhouette.

Logos and images to download

Genes.media provides its logo and those of Deep Time and Sapiens, with an image of each timeline. They are intended for presenting the timelines on a website or in course materials. They can be downloaded from the “For teachers” page of Genes.media: genes.media/for-teachers/





At the top, the whole Deep Time timeline. Below, a close-up of the last 550 million years.

The globe of the Sapiens timeline shows the routes that *Homo sapiens* had already followed 45,000 years ago.

Terms of use

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Your feedback

Have you used one of the timelines in class, put a link to it on your website or shared it with colleagues? Do you have a question, or an idea for an activity or for a feature that would help you? Write to us through the Genes.media contact form: genes.media/about/#contact

If you find these timelines useful, please tell your colleagues about them, on Facebook and other social media, or in the teacher groups you belong to.