BHP Unit 5 Overview | OER Project

Did you know that all living things on Earth share a common ancestor? That's pretty amazing, but what's even more exciting is how we discovered these connections. From the birth of life in deep ocean vents to the variety of life on Earth today, our understanding of how life evolved has changed, or evolved, over time.

0:12

Host Rachel Hansen standing in front of an animation of DNA.

Confession time. I don't fully understand DNA. But you can't hold that against me, there's a lot of it. Each human cell has about six feet of DNA. If you took the DNA from a single person and stretched it out it would be billions of miles long. So, it's a complicated topic, all right.

Animation of Rachel's head on a cat's body.

Still, I do know that we share 90% of our DNA with a cat and 85% with a mouse.

Animation of Rachel's body with a cat's head and a mouth in its mouth.

Ugh! But don't judge Mr. Tibblesworth too harshly. We do the same thing!

Image of a hamburger and a cow.

Like eating a hamburger. Yeah, that cow shared 80% of your DNA.

Animation of Rachel's head and bananas along a strand of DNA.

And…. What was that other thing? [cell phone rings] Yellow? Ah, that's right! Thanks. Sixty percent of banana DNA is the same as ours. The point is, everything that's alive has a lot in common.

1:17

Hi, I'm Rachel Hansen. And this is Unit 5, life. and don't worry eating a banana And don't worry, eating a banana doesn't make you a cannibal.

Video of a multicellular organism.

Those DNA percentages are a little misleading. Of course, we share DNA with all these other forms of life. We all evolved from a common multicellular eukaryote ancestor. But, why do we care about DNA in a history course? Well, our understanding of DNA has had some big consequences for the organization of human communities.

Images of scientists.

Throughout our history, many people tried to make others believe that some groups of people were inferior or fundamentally different based on things like skin color or place of birth. But, pick any two humans, say you and me, the genetic similarity between us is 99.9%. That remaining 0.1% percent, that's the tiny sliver of our genes that changes stuff like eye color, height, and whether or not you think cilantro is gross. We're all part of the same species. The overwhelming majority of scientists agree that there is no genetic evidence to support the idea of separate races. Race is a category created and given significance by human societies, not by our DNA.

2:44

How do we know this about ourselves and about our plant and animal relatives? Collective learning, of course. From ancient taxonomies to Charles Darwin, we've continued to improve our understanding of life on earth.

Image of scientists and science labs.

Beginning in the 1990s, scientists from dozens of different countries collaborated to build the Human Genome Project a 13-year study that mapped human DNA. Mapping the human genome has helped scientists understand why some people are more at risk of certain diseases. It's helped us understand how our species evolved. And it's confirmed that humans might be individually very different, but on a genetic level we share much more in common.

Understanding the grand story of life on earth from its single-celled origins to you helps us understand our human community and our connections to all life on earth. Armed with this information, perhaps we can begin building better more fair societies.

3:44

Animations of a super novae, of the solar system, and of accretion.

In Unit 4 we investigated how we went from a supernova explosion somewhere in the milky way galaxy to the creation of our solar system and earth. Dying stars like this supernova generated new chemical elements. Those new elements began spinning under the force of gravity to eventually come together in a series of violent collisions to form our solar system.

Animations and images of volcanoes, Earth's history, mountains, and continents drifting.

Next, we traveled to the Haitian Eon, when an early earth was a lava-covered asteroid-pelted noxious gas-ridden rock. We also learned why plate tectonics make earth so special, giving us soaring mountains and dramatic volcanoes. The movement of plates also created the initial ingredients for the evolution and diversity of life that we see today.

Text definition of Collective learning and Interdisciplinary.

Finally, we examined how collective learning helped us figure all this out. Scholars like the ancient natural philosopher Eratosthenes; geologists like Charles Lyle, Harry Hess, and Walter Alvarez; meteorologists like Alfred Wegener; and many others contributed to our knowledge of the origins of our solar system and our planet. The only place in the universe that we know can support life.

5:00

Threshold 5 graphic.

And that brings us to a new threshold of increasing complexity: life! What is life? Other than a terrible board game from the 1960s. Well, that's a complicated question without a super clear scientific agreement.

Text box outlining characteristics of life.

But, for this course, we define life as something that has four characteristics: reproduction, the ability to replicate; homeostasis, the ability to self-regulate—that basically means continue living—adaptation, the ability to respond to the environment; and metabolism, the ability to process energy. Oh, and we can't forget about DNA and RNA all living organisms, including you and your lettuce, contain this blueprint for life.

5:55

Threshold 5 graphic.

To emerge on earth life needed new complex chemical compounds like DNA and RNA, just the right amount of energy and water. This we know. What we don't know exactly is how life sprang from, well, not life.

Video of oceanic vents with caption defining prokaryotes.

The most accepted theory is that these complex chemical compounds made their way to deep oceanic vents, where lava spewed from the earth's mantle, into the oceans, thanks to plate tectonics. Here the lava escaped from fissures in earth's crust, mixed with the complex chemicals in water and formed single-celled organisms called prokaryotes.

6:39

Animated graphic of course timeline with thresholds.

So, how do we get from these basic single-celled organisms to us? Well, that required a few billion years of trial and error called evolution, which did not always go smoothly.

Animated graphic of photosynthesis of prokaryotes.

For example, those ocean-dwelling prokaryotes gradually moved from the deep ocean to the surface. As surface dwellers, prokaryotes evolved to take energy from the sun through photosynthesis, which also meant they changed earth's atmosphere by releasing oxygen. The atmosphere became so oxygen rich it triggered an event scientists call the oxygen holocaust as tons of bacteria went extinct.

Animation of an asteroid colliding with the Earth, killing the dinosaurs.	This is just one example of how life and earth have interacted over the last four billion years. There are plenty of others. Volcanoes have erupted and asteroids have impacted the earth setting off other mass extinctions like the one that killed the dinosaurs. Today, humans burning fossil fuels have already launched a new mass extinction event as climate change worsens.
7:42 *Image of Charles Darwin and his illustration of Finches with caption "Charles Darwin (1809-1882)".*	How do we know about the origins of life, how it evolved, and how life and earth affect each other? Well, as we like to do here at the Big History Project we'll ask the experts, starting with biologist Charles Darwin and his writings on natural selection.
Image with caption "Rosalind Franklin (1920-1958)".	Then, we'll investigate how chemists like Rosalind Franklin built upon Darwin's theory and provided even more evidence for how life evolves including the structure of DNA.
Animation of evolution of human beings.	Pay attention in this unit. Well, pay attention in all of them, but this one sets us up for a really important threshold, the one involving you and me.
Animation of cat with a mouse in its mouth.	And without the emergence of our ancient single-celled ancestors there'd be no you, no me, no cat, or mouse, no banana. That's an important fact to keep in mind as we think about our place in the grand scheme of life on our planet and in a universe of complexity.
Animation of a dead battery appears behind Rachel.	Great, the battery's dead.