



EVOLUTION

No More Monkeying Around

Lesson Set 4 of 5



NCSE
National Center for
Science Education

Teacher Prep



Age Levels: 9th-12th grade

Time Commitment: 10 days
(if all activities completed)

Key Vocabulary/Concepts:

Neanderthal, adapt/adaptation, great apes, Hominidae, hominids, phylogenetic tree, common ancestor, fossils, artifacts, selection pressure, phenotype, variation

Materials:

- Sticky notes
- Student handouts
- Device with internet access

Apps and Software:

- Google [Jamboard](#) or Google [Drawings](#)
- Internet browser
- Presentation software

Introduction

This lesson set explores the story of human evolution. Students investigate the origins of Homo sapiens and our evolutionary relationship to the primate family Hominidae. Students also discuss examples of recent human evolution over the span of recorded history and consider the traits that humans acquired as a result of evolution as well as the technology humans created to manage the impacts of these traits.



Teacher Goals

- 1) Provide structured opportunities for students to ask questions that drive the learning process.
- 2) Provide students with details of how humans fit within the primate family and how the hominin branch has evolved over time.
- 3) Explore and discuss examples of recent human evolution that has occurred as a response to environmental pressure in specific geographic locations.
- 4) Highlight the current work happening in the field and in laboratories to better understand human origins.



Student Learning Goals

- 1) Compare and contrast anatomical structures of different species in order to determine evolutionary relationships.
- 2) Interpret geographical data to create a map of the distribution of different species.

Evolution Lesson Set Series

<https://ncse.ngo/supporting-teachers/classroom-resources>



EVOLUTION

[Lesson Set 1: The Origin of a Species](#)

[Lesson Set 2: Good is Good Enough?](#)

[Lesson Set 3: It's Time to Lose the Ladder](#)

[Lesson Set 4: No More Monkeying Around](#)

[Lesson Set 5: The Road to Extinction](#)



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Student Learning Goals (continued)

- 3) Observe artifacts found with the remains of different species in order to infer behaviors of different species.
- 4) Analyze historical climate trends in order to form a hypothesis regarding the relationship between climate and human range expansion.
- 5) Obtain and communicate information in order to describe what we know about how hominid species lived and the ways in which the archaeological data supports the findings.
- 6) Apply understanding of evolution in order to understand how human populations have changed over the past 50,000 years in response to local environmental pressures.
- 7) Describe the traits that humans have inherited and identify the technology that humans have developed in order to manage these traits.

Background



Teacher Knowledge

Nature of Science

It's recommended that students work through the NCSE Nature of Science [lesson sets](#) at some point during the year. However, if this is not possible, be sure to introduce students to [FLICC](#), a framework for understanding science denial, prior to presenting this lesson set. *Part E: The Characteristics of Science Denial* in Nature of Science [Lesson Set 1: Science is a Way of Knowing](#) is especially valuable. It takes students through several examples of FLICC in action while dismantling common misconceptions about the COVID-19 pandemic. [Learn more](#) about FLICC.

Evolution

Evolution explains many aspects of biology and is an indispensable part of a life science curriculum. The scientific community sees evolution as the unifying principle of all biology. The biological unity of life on our planet can be understood by examining anatomical features, genetics, and embryological development; this evidence can be used to identify common ancestry of different species. Likewise, the diversity of life on our planet can be understood through the lens of evolution. Understanding human evolution is part of the story of the diversification of life on Earth, along with how humans have most recently evolved in response to regional selective pressures.



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Teacher Knowledge (continued)

Evolution (continued)

This lesson set is meant to help students understand the past, present, and future of human evolution, and teachers should review skeletal anatomy and the role of genetics in evolution in order to feel confident with these activities. Teachers may also want to reflect on their comfort level when talking about skin color and racial issues. If a refresher on evolution is necessary, consider checking out the University of California Museum of Paleontology “[Understanding Evolution](#)” resource, the Smithsonian National Museum of Natural History’s [Human Origins](#), or “[Evolutionary Adaptation in the Human Lineage](#)” by Stephen F. Schaffner and Pardis C. Sabeti before introducing this curriculum to your students.



Discussion Points

- How are modern humans related to other primates?
- Why is it misleading to claim that humans evolved from monkeys?
- What has been learned about human ancestors from fossils?
- What selection pressures have caused changes to human populations?
- How does recent human evolution relate to the diversity of people we see today?
- How have humans used technology to manage with our evolutionary traits?
- What questions about human evolution deserve further research and exploration?
- What aspects of human evolution may be difficult or impossible to answer?



Prerequisite Student Knowledge

Before starting the activities below, students should have some knowledge of extinct species, be able to identify some modern species, and describe how they resemble species from Earth’s past. Students should be able to express that the diversity of life on Earth is due to evolution and that the evolutionary relationship between species can be depicted using models such as cladograms and phylogenetic trees. Students should be able to identify a common ancestor of two or more species using such a model. Students should be able to describe natural selection and the ways in which populations change over time due to selection pressures. This lesson set is meant to apply this knowledge to a new or unfamiliar topic for students: human evolution.



Core Misconceptions

✗ **MISCONCEPTION:** *Humans evolved from monkeys.*

✓ **FACT:** Modern humans and monkeys share a recent common ancestor and are not descended from any other primate living today.

✗ **MISCONCEPTION:** *Humans cannot have evolved from primates because there are still primates.*

✓ **FACT:** Evolution is a branching, not a linear, process: the evolution of one species doesn't require the disappearance of the species from which it evolved.

✗ **MISCONCEPTION:** *Humans are the pinnacle of the tree of life and therefore no longer subject to the same challenges to survive and reproduce as other organisms.*

✓ **FACT:** Humans are animals that still face challenges to survive and reproduce just like all other organisms.

Teacher Instructions

Anchoring Phenomenon

Anchor: [The Uncomplicated Caveman?](#)

- Present students with the illustration of a “caveman” and a computer. Ask students to generate a list of words that come to mind as they observe the image. Write the words on your whiteboard or other common space as students are identifying them. After creating the list, use Think-Pair-Share to ask students to choose one of the words and explain it further, including why the image brought this word to mind.
- Show students [Geico Caveman Commercial, The Original](#) (0:12), followed by [Geico Commercial](#) (0:30). Ask students to explain how these commercials connect to what they already know about “cavemen.” Ask students to identify where they learned about “cavemen” and what those resources taught them. Students may identify TV series, books, movies, or other media.
- Introduce the word **Neanderthal**. Ask students to define what this word means. How are Neanderthals similar or different to us? Tell students they are going to watch a video about Neanderthals. As they watch, they should consider the following questions:
 - *How does this video connect to what you already knew about Neanderthals?*
 - *What new ideas caused you to extend your thinking in a new direction?*
 - *What challenges or puzzles emerge for you?*
- Show students the PBS Eons video [The Neanderthals That Taught Us About Humanity](#) (9:44). Ask students to share their responses to the questions above.



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Anchoring Phenomenon (continued)

- Share the *Artifact Evidence* images with students. Tell students that we have found evidence of Neanderthals engaging in what was at the time complex work: making tools, weaving fibers, and even creating artwork, such as carvings or cave paintings. Students may question how the middle image constitutes art. Explain that it was carved from a deer toe, a part of the animal that does not have any edible meat. Therefore, it was not carved in order to access food. Second, the toe needed to be boiled to make it soft enough to carve, which means there was forethought into this activity. Finally, the carvings were done in a deliberate fashion. Tell students that Neanderthals were also known to care for others who were wounded or ill and used rituals as a part of their burial process.
- Pose the following questions to students and allow time for silent reflection:
 - *What does it mean to be human?*
 - *What are your human origins?*
- Once students have had an opportunity to reflect on these questions, present the Driving Question Board.

Driving Question Board: No More Monkeying Around

- If you're working in person or without access to digital media, then create a physical version of the Driving Question Board that can be displayed prominently in the classroom. Provide students with sticky notes so they can add their questions to the board.
Note: The sample Driving Question Board (DQB) can be found in the Teacher Resource Folder above. Please make a copy of the template provided before beginning the activity.)
- Organize students into pairs. This will allow them to have someone to help develop their questions. On the class DQB, have each student pair type or write one or more open-ended human evolution questions on separate sticky notes, along with their initials. Open-ended questions require answers beyond yes or no or a single word. If students are struggling to think of open-ended questions, have them consider questions related to the common ancestor of the Neanderthals and modern humans, the future of human evolution, or environmental pressures that determined the path of human evolution. Sample open-ended questions include:
 - *What traits do Neanderthals and modern humans share with their common ancestor?*
 - *Are humans still evolving?*
 - *What environmental pressures might have played a role in making opposable thumbs an **adaptation**?*
- Read a few of the student-generated questions aloud to the class. Inform the class that you will read all sticky notes later and organize them into groups. After class ends, arrange similar questions into categories and add subtitles above the sticky notes.
- The DQB is meant to guide instruction and therefore should be referenced periodically, such as at the start of a class or when transitioning between activities, to highlight what questions have been answered and where the storyline is headed next. Not all student-generated questions will be answered. At the end of the storyline, teachers may elect to have students do research to address the unanswered questions.



Storyline Activities

Part A: All in the Family

- Note: The Teacher Resource Folder for *Part A: All in the Family* includes a detailed material list and teacher instructions for completing this activity. Please be sure to check the *All in the Family Teacher Guide* prior to beginning this activity.
- Present students with the following question: *Who is our closest living relative on this planet?* As students are giving their answers, generate a class list in a common space, such as a whiteboard.
- Show students the *Primate Phylogenetic Tree*. Tell students that we are one of four extant **great apes**: humans, chimpanzees and bonobos, orangutans, and gorillas. This taxonomic family is called **Hominidae**, but species in this group are more commonly referred to as hominids. Ask students to use the **phylogenetic tree** to determine which is closest to us in regards to evolutionary relationships. Students should be able to determine that chimpanzees and bonobos are the most closely related to *Homo sapiens*.
- Tell students that the most recent **common ancestor** between chimpanzees and humans was alive approximately six million years ago. Then tell students that they are going to be examining **fossils**, **artifacts**, and other evidence in order to construct a model that describes what happened during that time which resulted in two distinct genera: *Pan* and *Homo*.
- **Activity Variation 1:**
 - Organize students into small groups and provide them with the *All in the Family Student Handout* and use the *All in the Family Teacher Guide* to drive discussion over the course of 2–3 class periods. This variation provides more time for students to analyze the evidence and make inferences.
- **Activity Variation 2:**
 - Do not provide students with the *All in the Family Student Handout*. Instead, organize students into working pairs and use the *All in the Family Teacher Guide* to drive classroom discussion. This teacher-guided discussion can take as little as one 45-minute class period. This variation provides a shorter amount of time for students to analyze evidence and is more directed.
- Throughout the activity, students and the teacher should reference the *All in the Family – Human Ancestry Model* and add information to it.

Note: This activity may elicit questions regarding bias, sexism, or racism. The All in the Family Teacher Guide has information regarding how to address these questions with students as well as additional activities that address these ideas. It is important that students think critically about history and the role that bias has played in science in order to understand the impact future choices will have.
- **Anchor to Activity**—Revisit the Driving Question Board with students. Were any of their questions answered? Did any new questions emerge for them? For any answered questions, ask students to identify evidence from the activity that supports the answer and provide reasoning for how the evidence does this. Any new questions should be written on a sticky note and added to the DQB; ask students to identify what from the lesson inspired this new question.
- **Acknowledgement:** “All in the Family” was developed using resources created by Armin Moczek. The original resources can be found in the Outreach section of the Moczek group website “[On the Origins of Novelty & Diversity in Development & Evolution](#).”



Storyline Activities (continued)

Part B: The Human Story

- Ask students to reflect on their own social media experiences using these guiding questions. As students share their responses, generate a list of the students' ideas in a common space, such as a whiteboard or Google Jamboard:
 - *What are your favorite platforms, and how have your preferences changed over time?*
 - *What kinds of posts do you enjoy making?*
 - *What kinds of posts do you enjoy watching?*
 - *Imagine looking back at your current social media activity 10 to 20 years in the future. What will you make of these posts?*
 - *What might people 100 to 1,000 years in the future think about these posts?*
 - *What kinds of artifacts do we look at today to understand what people were like 100 years ago or more?*
- Introduce students to the Smithsonian National Museum of Natural History's [Human Origins](#) website. Open the [Human Family Tree](#) and demonstrate for students the four major branches of the tree. *Note: this website, though it is one of the most complete, lacks several of the more recent hominid discoveries. Information on these can be found in the Teacher Resource Folder.*
- Review the *All in the Family* activity from the day before by asking students to identify which hominid species left behind different types of artifacts. Ask students to identify which species on the tree had access to social media. Then ask students to identify which had the ability to read and write. Ask students to identify which had the capacity to make art. Finally ask students to ask which was able to make tools. Remind students that in the last activity they used artifacts in order to make inferences about how earlier hominid species lived.
- Pass out *The Human Story Student Handout*. Read the background information with the students, then describe the project to students. Students will gather information about one of the hominid species, then create a project that depicts the way in which this species lived. Students will include the species' evolutionary adaptations, geographical range, technology and food sources.
- Using this information, students will create a modern-day artifact that this species might create if it were alive today. Students should consider the following questions as they create their artifact:
 - *What images might have been most important to this species?*
 - *What might a typical day look like for this species?*
 - *What skills or strengths would this species have wanted to demonstrate to others?*
 - *What activities might this species enjoy participating in?*
- After students have completed their project, provide time for students to share their findings with each other.
- **Activity Variation:** Instead of creating modern artifacts, students could instead participate in a Data Dash-style presentation. Students should create one presentation slide with all the required information. Students then have 3 minutes to present their findings to their peers.



Storyline Activities (continued)

Part B: The Human Story (continued)

- **Anchor to Activity**—Along with students, look back at the Anchor activity. One of the questions students had to consider was “What does it mean to be human?” Ask students to identify the adaptations present in other branches of our evolutionary tree that we share with these species. For example, *Australopithecus anamensis* had an ankle bone that indicates it was capable of bipedal walking and *Homo heidelbergensis* was able to survive in colder climates. Consider as well the type of technology each species was able to use. Which were capable of controlling fire or creating shelter? Which possessed the ability to create art or had ritualistic burial?

Part C: Human Evolution

- Show students the TED-Ed video [Is human evolution speeding up or slowing down?](#) (5:26). As students are watching, ask them to consider the following questions:
 - *Identify one of the human adaptations mentioned in the video. What was the selection pressure that caused this adaptation to become more common?*
 - *What argument can be made that human evolution is slowing down?*
 - *What argument can be made that human evolution is speeding up?*
- Provide time for students to discuss the above questions. Consider using the Think-Pair-Share routine in order to promote discussion.
- Using one of the [HHMI Human Evolution](#) classroom activities, provide students with the opportunity to explore how human populations have adapted to local **selection pressures**. Another option is to utilize HHMI’s [The Biology of Skin Color](#) activity.
- **Anchor to Activity**—Revisit the Driving Question Board with students. Were any of their questions answered? Did any new questions emerge for them? For any answered questions, ask students to identify evidence from the activity that supports the answer and provide reasoning for how the evidence does so. Any new questions should be written on a sticky note and added to the DQB; ask students to identify what from the lesson inspired this new question.

Part D: Revisiting Darwin

- With students, review the word **phenotype**. Ask students to share what this word means and give examples. If you have not defined phenotype, create a classroom definition. Ask student volunteers to stand up and describe their personal phenotypes. For each of the different traits identified, ask other students to describe how this trait varies in our global human population. For example, a student may describe their hair as blond, then describe hair color **variation** as including blond, black, brown, and red.



Storyline Activities (continued)

Part D: Revisiting Darwin (continued)

- Show students the following quote by Salvador Dalí: “*Don’t be afraid of perfection. You will never attain it!*” Ask students to consider the phenotypic traits we have that come with perceived imperfections. If the students benefit from an example, tell students that there is a variation in our ability to see at distance, and that some people become more nearsighted over time to a variable degree. Students may also identify that although all people are susceptible to skin cancer due to sun exposure, those with lighter skin tones burn more easily. Students may also identify that although most people have a set of wisdom teeth, whether or not they need to be extracted depends on the variation in the size of human jaws. Generate a list of human traits that may be perceived as imperfections on a whiteboard or anchor chart.
- For each of the traits students identify, ask them to then identify a technology that humans have created to help us manage these traits. Students may identify glasses to overcome nearsightedness, sunscreen to prevent sunburn, and dental surgery to overcome impacted wisdom teeth.
Note: Focus the conversation on evolutionary traits rather than imperfections, drawing the conversation away from any students’ who may bring up perceptions of beauty. For example, students could discuss how a larger head at birth is helpful for the development of our large brains, but can cause problems in childbirth, not whether or not wider hips are more subjectively attractive.
- Show the video [Should evolution have created this as the perfect human body? - BBC \(2:36\)](#). As students watch the video, they should consider the following questions:
 - *What do you notice about the “perfect” human?*
 - *How does this compare to the human species as it currently looks?*
 - *How does it compare to past hominids?*
 - *What questions does this raise for you?*
- Choose one of the articles from the Teacher Resource Folder and ask students to answer the following questions as they read:
 - *What adaptation is this article about?*
 - *What environmental pressure could this have been in response to?*
 - *What are the downsides to this adaptation?*
 - *What changes to our anatomy would prevent these downsides?*
 - *What factors did not exist that could have prevented this?*
- Ask students to reflect back on the video and the paper they have just read. What connections can be made between the two?
- **Anchor to Activity—Tying it All Together:** Provide students with the opportunity to go back to the original questions they asked. Give time for students to reflect on what their question was, how what they learned related to their question, and what new questions they have. Prompt students to think about how scientists might learn the answers to these questions or how they might go about researching them themselves. Students should share their reflections either in small groups or with the whole class.



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Storyline Activities (continued)

Time After Deep Time Check-in: No More Monkeying Around Timeline Cards

- If you would like students to create a timeline of biological and geological events connected to evolution throughout the NCSE evolution curriculum, review the teacher guide and materials for [Evolution Lesson Set 5](#), Part D: Time After Deep Time, Variation 2: Integrated Activity.
- Have students set up the timeline. You may choose what event cards you would like to have students add to the timeline and when. Event cards are provided at the end of each lesson set.
- For this lesson set, students will sequence the major events that occurred in hominid evolution by putting the timeline cards in the order of occurrence they think best reflects hominid evolutionary changes. *No More Monkeying Around Cards* are a part of a bigger card set that connects each of the National Center for Science Education evolution lesson sets together.



Extension Activities

Deeper Dive

- [Human Evolution Teaching Materials Project](#)
- John Hawks Weblog: [Paleoanthropology, genetics, and evolution](#)
- HHMI Biointeractive: [Activity for *The Biology of Skin Color*](#)
- Smithsonian National Museum of Natural History: [Lesson Plans](#)
- PBS: [Meet Your Ancestors](#)



Online Resources

» [Teacher Resource Folder](#)

» [Geico Caveman Commercial, The Original \(0:12\)](#)

» [Geico Commercial \(0:30\)](#)

» [The Neanderthals That Taught Us About Humanity \(9:44\)](#)

» [Is Human Evolution Speeding Up or Slowing Down? \(5:26\)](#)

» [Should evolution have created this as the perfect human body? - BBC \(2:36\)](#)



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