# How to Build a Human

## In Seven Evolutionary Steps

# ACTIVITY KIT

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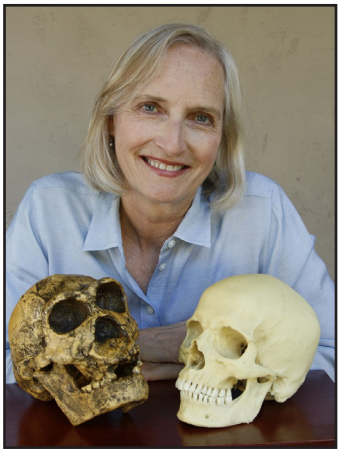
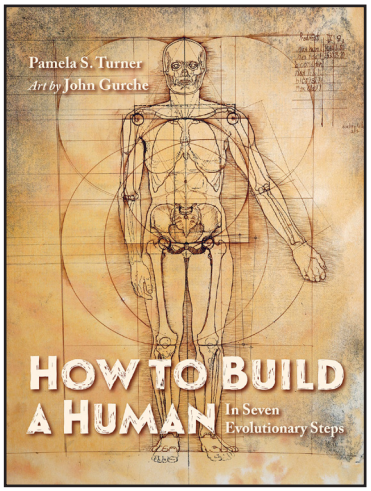
★ "Glints of fun light up a rock-solid dig into our Stone Age ancestry."
—*Kirkus Reviews*, starred review

★ ". . . buoyed by an amused stance, joke-filled footnotes, well-chosen shifts into second person, and modern-day analogies attuned to a middle-grade audience."
—*Horn Book*, starred review







Pamela S. Turner
Art by John Gurche
978-1-62354-250-4 HC
*e-book available*


## ABOUT THE BOOK

How did we become who we are? With trademark wit, acclaimed science writer Pamela S. Turner breaks down human evolution into the seven most important steps leading to *Homo sapiens*. How, when, and why did we:

1. stand up,
2. smash rocks,
3. get swelled heads,
4. take a hike,
5. invent barbecue,
6. start talking (and never shut up), and
7. become storytellers?

This fascinating, wickedly funny account of our evolutionary journey turns science into an irresistible story. Vetted by experts at the Smithsonian's Human Origins Program, the book also features incredibly detailed portraits by celebrated paleo-artist John Gurche that bring our early ancestors to life.

## ABOUT THE AUTHOR

Pamela S. Turner has a master's degree in public health from the University of California, Berkeley. She is the author of several award-winning books for young readers, including *Samurai Rising*, a YALSA Excellence in Nonfiction Award finalist, and *Crow Smarts* and *The Frog Scientist*, both winners of the AAAS/Subaru SB&F Prize for Excellence in Science Books.

## ABOUT THE ILLUSTRATOR

John Gurche is one of the most respected paleo-artists in the field. His works have appeared in *National Geographic* and *Scientific American* and at the American Museum of Natural History, the Field Museum of Natural History, and the Smithsonian Institution.

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# DISCUSSION GUIDE

Use these questions to kick off classroom discussion, guide pre-thinking and post-reading responses, or inspire a writing assignment.

Next Generation Science Standard: MS-LS4

## HUMANS AND OUR ANCESTORS:

1. How are humans like other primates?
2. Draw a diagram of human evolution, from our common ancestor with chimpanzees and bonobos to *Homo sapiens*, using the hominin species described in *How to Build a Human*.
3. How are our hands, feet, legs, skulls and teeth different than those of our earliest ancestors?
4. What is the evidence for an "artistic sense" among human ancestors?
5. Why is tool use and toolmaking considered an important step in human evolution?
6. Sharing is caring. Evidence points to Handy People sharing their food with each other. How is this like the social skills and bonds we're familiar with today?
7. Do you play team sports? How is a team like an Australopith or *Homo habilis* social group?
8. What is the connection between language and teaching? Why would these behaviors evolve?
9. Name three advantages of fire that do NOT involve cooking food.
10. What are some advantages of being able to stand upright and walk on two legs?
11. Which evolutionary step to becoming human do you think is the most important? Why?

## EVOLUTION:

1. Define *natural selection*. How does it happen? Can you give an example of how natural selection has influenced a human trait?
2. What is the one lesson about evolution the author urges you to remember? Why is it important?
3. Why do some species go extinct? Why do other species survive?
5. The author says that evolution's motto might be, "Yeah. Good Enough." What other mottos might describe evolution?
6. In Step 7, the author discusses how a flip-flopping climate may have driven our ancestors close to extinction. Consider the climate change we are currently experiencing and its impact on plants and animals. In warmer environments, what sort of traits might be selected?

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# TRACK YOUR TOOLS

This discussion and exercise underscores the importance of tools in the evolution of modern humans.

## DIRECTIONS:

1. Open with a classroom discussion: What is a tool? Review Pamela S. Turner's definition of tools in Step 2—among animal-behavior scientists, a tool is "an unattached object used to manipulate something else." For example, your toothbrush is a tool, and so is the toothpaste tube. The toothpaste isn't. Are there any holes in this definition? Deciding what meets the scientific definition of a "tool" can be tricky—others may disagree with what you label a tool.
2. Ask students to list every tool they use during the course of a day. Optionally, you may assign this as a daylong or weeklong project, asking students to tally the number of times they use each tool.

## DISCUSS IN SMALL GROUPS:

1. Were you surprised by how many tools you use? Did you think you would use more or fewer?
2. Of the tools listed, which do you use most often? Which do you like best? Why?
3. Who made your tools? How did you get them? How is this different or similar to the way that your hominin ancestors got and made tools?
4. How many tools did you improvise or use in an unintended way? How is this problem-solving behavior like or unlike something one of your hominin ancestors would have done?
5. At what point in your life did you learn to use each tool? How did you learn to use them?
6. Do you think you could get through a day without using any tools at all? What would that day be like?
7. Is there a daily task that you wish could be simplified by using a tool? What would such a tool look like?

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## Activity Kit

## Science Connection:
# Rule of Thumb

This classroom activity demonstrates how our ancestors shaped and were shaped by the tools they made.

## You Will Need:

- Several rolls of body-safe medical tape
- A timer
- An assortment of tools, including but not limited to:
  - **A:** Toothbrushes, toothpaste, and a trash can
  - **B:** Pens, pencils, crayons, and markers in a variety of sizes
  - **C:** Letter-size paper and scissors
  - **D:** Goggles and button-front lab coats in a variety of youth sizes
  - **E:** Snack-size, individually wrapped granola bars or other foods*
  - **F:** Small cans of fruit, can openers, and forks*
  - **G:** Hand trowels and a tray of sand or potting soil
  - **H:** Dixie cups, a box full of small beads, and spoons
- Cleaning supplies

(*Remember to check student allergies!)

## To Set Up:

1. Arrange classroom furniture to establish several stations around the room. With respect to the demands of time and the size of your class, consider establishing only three or four of the eight options listed above.

2. Set up each station with a set of tools for students to attempt a routine task. For example, at station A, students might attempt to brush their teeth. At station B, they might attempt to write their name. At station C, they might attempt to make a paper heart. At station D, they might attempt to don a pair of goggles and a button-front garment. At station E, they might attempt to open a snack. At station F, they might attempt to open a can and eat the contents with a fork. At station G, they might attempt to dig a hole. At station H, they might attempt to fill their cup with beads from the box.

3. Label each station with directions for the task. (See page 7 for premade signs or make your own.)

4. Make copies of the Rule of Thumb worksheet (page 6) for students.

## Directions:

1. Begin by introducing students to their own hands. Ask them to observe their hands closely, compare and contrast them to their neighbors' hands, and reflect on how they use them in their daily lives.

2. Discuss the evolutionary origins of human thumbs. Early human ancestors had chimp-like hands with long fingers, long palms, and short thumbs. The individuals in any population vary slightly. During the process of evolution through natural selection, those early human ancestors with slightly shorter palms, shorter fingers, and a longer, stronger thumb were better able to use tools to survive. They passed these helpful

## SCIENCE CONNECTION:
# RULE OF THUMB (CONT'D)

This classroom activity demonstrates how our ancestors shaped and were shaped by the tools they made.

## DIRECTIONS (CONT'D):

2. (cont'd) traits to their offspring. Scientists think that over a long period of time, these traits spread and eventually produced a new population with more useful hands. We inherited these hands from our ancient ancestors.

3. Direct students to the activity stations around them. Invite them to try each of the activities in small groups, giving them several minutes to complete each task before rotating. Students should use their scoring sheets to mark how easily they accomplished each task. 5 indicates a very easy task; 1 indicates a very difficult task.

4. Now, distribute rolls of medical tape to each group and direct students to tape their thumbs to their hands, leaving their fingers free.

5. Direct students to try each activity again without the use of their thumbs, giving them several minutes to complete each task before rotating. Again, students should use their scoring sheets to mark how easily they accomplished each task.

6. Use the discussion questions below to reflect on the experience as a class or to prompt written assignments.

## DISCUSSION:

1. Which task was the easiest with thumbs? Without thumbs? Why?

2. Which task was the hardest with thumbs? Without thumbs? Why?

3. Do you think tasks are easier with thumbs because thumbs offer an inherent advantage, or because we've shaped our tools to fit hands with thumbs? (This is a chicken-and-egg question!)

4. What strategies did you figure out to adapt to thumbless tasks? Pamela S. Turner emphasizes the importance of cooperation in human success; did your groupmates figure out and share particular tricks of operating a spoon, can opener, or button without thumbs? How did you teach each other?

5. Not everyone has thumbs—some people are born without them or lose the use of their thumbs due to injury or illness. What are some adaptive tools that help people perform daily tasks without using thumbs (ex: voice-to-text programs, ergonomic pens, etc.)? Think about the task you found most difficult without thumbs. How would you design a tool to help someone perform that task?

# RULE OF THUMB

Use this scoring sheet to indicate how you did on each task before and after taping your thumbs. 5 indicates an easily-accomplished task; 1 indicates a very difficult task.

## BRUSH YOUR TEETH

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## WRITE YOUR NAME

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## MAKE A HEART

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## PUT ON CLOTHES

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## EAT A WRAPPED SNACK

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## EAT A CANNED SNACK

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## DIG A HOLE

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

## FILL YOUR CUP

Thumbs: 1 2 3 4 5

No thumbs: 1 2 3 4 5

BRUSH YOUR TEETH.

WRITE YOUR NAME.

MAKE A HEART.

PUT ON CLOTHES.

EAT A WRAPPED SNACK.

EAT A CANNED SNACK.

DIG A HOLE.

FILL YOUR CUP.

## SCIENCE CONNECTION:

# FAMILY TREE

Draw a family tree of human ancestors, from our last common ancestor with chimpanzees to *Homo sapiens*.

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## ART CONNECTION:

# CAVE STORIES

This three-day classroom activity explores the role of art in ancient hominin life.

## YOU WILL NEED:

A roll of butcher paper
Paints, brushes, rags, and other painting supplies
A flickering light source such as an electric candle

## TO SET UP:

1. Completely cover a classroom wall with a long piece of butcher paper.

## DIRECTIONS:

1. On day 1, open class with a discussion of storytelling. Why does Pamela S. Turner name storytelling as one of the seven steps our ancestors took to become human? What evidence do we have of these prehistoric stories? How do students think life would be different if humans didn't tell stories?

2. Turn the discussion to ancient art. How long have humans and our ancestors been making art? What are some places where ancient art has been found? Why do students think hominins chose those places? What were some of the things they depicted? Why? What tools and pigments did they use? As a class, review some images of prehistoric art (including pages 98, 99, 112, 113, 120, 121, and 122 from *How to Build a Human*). What do students notice about color, line, and form in these artworks?

3. The modern world is full of animals, plants, buildings, and machines that our hominin ancestors never encountered. Ask students to draw one of these things in a cave-art style, carefully considering their use of color, line, and form.

4. Issue a challenge: How would students describe their school day in a way that an ancient *Homo sapiens* would understand? What story would they tell to explain their daily life as a young, modern *Homo sapiens*? **Homework: Assign a page-long "Day in the Life" writing assignment that tells this story.**

5. On day 2, ask students to gather in small groups and discuss their writing assignments. What are the similarities and differences between their stories? As a class, try to distill the stories into a set of bullet points describing the major events of the day.

6. Now that the class has a Day in the Life story, introduce the butcher paper as the cave wall on which students are going to tell their prehistoric story. Break the class into small groups again and divide the bullet points between them. Encourage students to think again about line, form, and color. Optionally, for inspiration, set up a slideshow display of ancient art examples to play while students work.

## ART CONNECTION:
# CAVE STORIES (CONT'D)

This three-day classroom activity explores the role of art in ancient hominin life.

## DIRECTIONS (CONT'D):

7. On day 3, give students time to finish work on their cave art if needed. Once the mural is done and everyone is satisfied with their work, it's storytime!

8. Turn off the lights and draw the blinds so that the classroom is as dark as possible. Using a flickering light source such as an electric candle, illuminate each event in turn, accompanied by a dramatic reading of your class's Day in the Life story. Applaud everyone's hard work.

9. With the lights back on, wrap up the Cave Stories activity with some self-reflection. What did students think of their work once they saw it all together? How did the change in lighting affect the way they saw their illustrations? How do they think a hominin of the far future would interpret their cave story if it survived several millennia?

10. Optional extension, in writing: "Think about how visual stories are told today. Picture books, animated movies, and graphic novels all use images to communicate. In 500–1000 words, describe your favorite visual story from an ancient hominin's point of view. Include the title of the visual story in the header of your paper."

## WRITING CONNECTION:

# WHAT ONCE WAS & WHAT COMES NEXT

This exercise brings together scientific research and writing to explore ideas about prehistory and evolution.

## DIRECTIONS:

1. Begin class with a discussion about scientific writing. How does *How to Build a Human* compare to other science writing that students have read? How is it like or unlike a news article, a textbook, or a *Bill Nye the Science Guy* script? What style of science writing do students prefer—humorous, short, long, narrative, expository?

2. Preview two possible writing assignments for students: **What Once Was** and **What Comes Next**. Students may pick the one they prefer.

## WHAT ONCE WAS:

1. Select a prehistoric life-form (a dinosaur, hominin, or other ancient animal) and conduct some research about its life cycle, environment, and behavior. How do scientists know what they know about this creature? What are the challenges it faced? How was it adapted to its environment? Is there something surprising, humorous, or otherwise noteworthy about it? What are some of the big questions yet unanswered about this creature? Do we know why it went extinct?

2. Write a piece of science writing (800–2000 words) featuring this creature. Include as many factual details as you can about the creature, its environment, etc. At the end, include a bibliography.

## WHAT COMES NEXT:

1. Review Pamela S. Turner's seven evolutionary steps between our oldest known hominin ancestor and modern humans. Think about overall evolutionary trends like the progressively smaller jaw, bigger brain, stronger thumbs, and fewer teeth; consider how our environment changed us and how we changed our environment.

2. Write a piece of speculative science writing (800–2000 words) featuring a future hominin, a member of a species evolved from *Homo sapiens*. How is the new species different? How is it similar? What changed in our environment to encourage this evolution? Include page references to *How to Build a Human* where appropriate.