



Directions:

print, complete, staple together, & submit pages: 1,5,6,7,8,11,12,13

Humanity on the Record

Preview

Activate Schema. Scan to see what you know about prehistoric mankind, origin of man, and dating old bones.

Establish a Purpose for Reading. What do you need to learn?

Vocabulary: complete page 7 before reading the selection.

Read & Integrate Knowledge

Predict Picture Relate Monitor Fix

In the summer of 2012, paleontologists working on a fossil excavation in Kenya announced that the human race, as we know it, was never alone. Scientists unveiled pieces of skull and bone that are approximately 2 million years old. Their discovery confirmed what earlier fossil findings had introduced as a possible piece of the human origin story: that humankind is merely one of a number of human-like species, each with its own lifespan. Every other species has been long extinct, making *Homo sapiens*, our species, the sole surviving member of the extended human family. Indeed, these findings have confirmed that the family was bigger than anyone had previously imagined.

In conversations about prehistoric evolution, whether humans evolved from apes, is a common but misleading question. Evolution, at its core, is a process that spawns a diversity of species. Some are quite similar and some are quite different. Some strains of evolution take place over millions of years, while other strains (for example, microorganisms that pass through multiple generations in the span of a day) take place over a number of months, even weeks. To track the evolution of various organisms over time

is to reveal the natural world's knack for never putting all of its bones in one basket, so to speak.

Dating Prehistoric Man: Not as Awkward as It Sounds

A more revealing question, then, is scientists' inquiry into multiple branches of the Homo genus. Assembling a "fossil record" over the course of two centuries, scientists have amassed enough evidence to date the earliest known appearance of Homo sapiens to about 200,000 years ago. Their research has also proven that a number of human-like species preceded and accompanied Homo sapiens on the prehistoric timeline.

The creation and preservation of an accurate fossil record is no easy task. Bones dug up from the ground don't often offer much information about their own age, so paleontologists have developed several methods to analyze the earth surrounding those bones instead. By inspecting the proximity of a fossil, one can figure out approximately (sometimes precisely) when the fossil itself was actually a living organism.

Radiometric dating—the use of technology to detect radioactive elements to identify the age of whatever those elements are in—is a precise but limited technique for determining the age of a fossil. The precision of radiometric dating comes from the fact that radioactive elements have clear, well-documented decay times (or how long it takes for traces of an element to disintegrate). Using this technique, scientists can narrow down the age of a fossil, even one that's over 50 million years old, to a very close estimate. Unfortunately, radiometric dating only works when radioactive elements were present in the first place.

The alternative method of dating fossils is stratigraphy. Based in the geographic study of layers of sediment that have stacked on top of each other for ages, stratigraphy includes a host of techniques for analyzing these various layers to determine the age of objects found wedged within them.

Simply put: If people find a fossil between two layers of dirt, and they know how old those layers of dirt are, they can then say the fossil was part of a living creature between those dates.

Stratigraphy can be difficult to execute in the study of fossils, since dirt doesn't always stack up in neatly preserved layers. There are often interruptions in the layers or portions of sediment that ended up being mixed together or eroded. Furthermore, the precision of this technique is said to be relative. Every estimate based on stratigraphic analysis depends on a comparison between other samples and other estimates.

Yet, by reviewing each other's evidence and sharing their findings, researchers are able to make reasonable confirmations of the global fossil record. Radiometric dating and stratigraphic dating are used to establish prehistoric records of fossils. Those records are then used to build a logical timeline for the evolution of many species. When new fossils are dug up, a fossil record spanning the ages is there to help scientists figure out where their new discoveries fit into the stories of the earth.

To Err Is Human; to Evolve Is Much More

One of the most fascinating stories, of course, is the prehistory of the human race.

The National Museum of Natural History puts it eloquently: "While people used to think that there was a single line of human species, with one evolving after the other in an inevitable march towards modern humans, we now know this is not the case. Fossil discoveries show that the human family tree has many more branches and deeper roots than we knew about even a couple of decades ago."

Presenting an interactive display of humanity's prehistory, the museum identifies over 15 different species related to humankind. The fossil record reaches back over 6 million years, marking the earliest known appearance of a primate species that walked upright. Two million years later, the record proves the existence of *Australopithecus Anamensis*, a bipedal species that was equally adept at walking upright and climbing trees.

Homo habilis, whose fossils date back 2 million years ago, was the earliest known species of the *Homo* genus. The age of *Homo habilis* closely follows the first known appearance of stone tools. It also coincides with the existence of at least three other human-like species, ape-like creatures that also walked upright. The stone tools discovered from these years were likely used by all of the species, following evolutionary paths that were similar but far from identical.

Even *Homo sapiens*, the species encompassing every human being on the planet right now, were accompanied by similar species. To be exact, at least four other human species have been added to the fossil record for the past million years. The simultaneous existence of *Homo erectus* and *Homo heidelbergensis*, *Homo floresiensis* and *Homo neanderthalensis* covers a period when the human races developed much larger brains and began to form the basis for modern civilization.

One by one, the other races have gone extinct. The hypothesized reasons range from an inability to adapt to climate change to murder at the hands of more advanced humans. Disease, physical disadvantages, and natural disaster have been discussed as possible causes. Some scientists argue that Neanderthals may have bred with early populations of modern humans, changing the record of their extinction to one of possible assimilation.

Thus, precise causes for the ascendancy of *Homo sapiens* have yet to be proven. The fact that fossils represent less than 5% of all known living species in the history of the world makes it very difficult for even the brightest paleontologists to gather enough evidence to answer all the questions they have about the origins of man.

What the world has gained through their work, though, is less a story of primates transforming into humans than it is the story of humanity's many extinguished flames. At the moment, our human race carries the torch for millions of years of evolution—among species, across continents, and through the ages.

Recall

5

Comprehension Questions

(circle the best answer)

1. What are *Homo sapiens*?
 - A the use of technology to detect radioactive elements
 - B a fossil record that covers two centuries
 - C our species, the human race
 - D a species that has gone extinct

2. What sequence of events does this passage describe?
 - A This passage describes the daily routine of *Homo neanderthalensis* and *Homo heidelbergensis*.
 - B This passage describes the appearance and disappearance of different species related to humans.
 - C This passage describes the steps that paleontologists took to find pieces of human skull and bone in Kenya.
 - D This passage describes the assembly of a fossil record that dates *Homo sapiens* to about 200,000 years ago.

3. Fossils can provide information about the history of humankind.
What evidence from the passage supports this statement?
 - A "Assembling a 'fossil record' over the course of two centuries, scientists have amassed enough evidence to date the earliest known appearance of *Homo sapiens* to about 200,000 years ago."
 - B "At the moment, our human race carries the torch for millions of years of evolution—among species, across continents, and through the ages."
 - C "Some scientists argue that Neanderthals may have bred with early populations of modern humans, changing the record of their extinction to one of possible assimilation."
 - D "The simultaneous existence of *Homo erectus* and *Homo heidelbergensis*, *Homo floresiensis* and *Homo neanderthalensis* covers a period when the human races developed much larger brains and began to form the basis for modern civilization."

4. Imagine that a group of scientists has just dug up a fossil. What would probably give them the most information about the age of that fossil?
 - A the fossil itself
 - B the earth around the fossil
 - C the air around the fossil
 - D the water around the fossil

5. What is this passage mostly about?

- A the appearance and behavior of *Homo heidelbergensis*
- B the question of whether humans evolved from apes
- C the use of radiometric dating to determine the age of fossils
- D the development and fossils of prehistoric humans

6. Read the following sentence: "If people find a **fossil** between two layers of dirt, and they know how old those layers of dirt are, they can then say the fossil was part of a living creature between those dates."

What does the word **fossil** mean in the sentence above?

- A the slow development of a species over time
- B part of a living thing that has died and remained in the ground for a long time
- C a method that scientists use to determine the age of bones they find in the ground
- D an early human-like species that walked upright and probably used stone tools

7. Choose the answer that best completes the sentence below.

There are several methods for dating fossils, _____ stratigraphy and radiometric dating.

- A therefore
- B earlier
- C also
- D including

8. What did scientists discover on a 2012 fossil excavation in Kenya?

9. What did this discovery tell scientists?

10. Explain how fossils can teach scientists about the development of humans. Support your answer with an example from the passage.



Researchers Beginning to Better Understand False Memory Formation

Alissa Fleck

Preview

Activate Schema. Scan to see what you know about memory, its reliability, when it happens, what its used for.

Establish a Purpose for Reading. What do you need to learn?

Vocabulary: complete page 13 before reading the selection.

Read & Integrate Knowledge

If you think planting false memories only happens in the movies, think again. False memories happen all the time in humans—we frequently misremember how, when and why certain things happened. We misremember small details, but also major events. Often we misremember things that happened only recently. Now scientists are on the path to finding a better means of understanding why false memories happen to people, by learning how to plant them in the first place.

According to James Gorman in an article in the *New York Times* in 2013, researchers are already able in experiments to convince humans to remember certain words and images inaccurately. A recent study by scientists at the Massachusetts Institute of Technology (MIT) took this process a step further by planting entirely false memories in mice.

Though mice and humans are very different creatures, their memory formation processes are similar. Studying the memories of mice has helped researchers understand exactly what goes on in the brain during the formation of fake memories.

A team of scientists at MIT, who published their findings in the journal *Science*, found they could convince mice they had been shocked in a certain location when they had not in fact been shocked there.

The scientists first allowed a group of mice to become comfortable in a certain area without being shocked. They then introduced the mice to a second area where they received shocks, while stimulating the parts of their brains that had become activated while exploring the first area in peace. Next they put the mice back in the original area. The mice froze in fear of being shocked, though they had no actual memory of being shocked there. The activation of the brain cells while shocks were being delivered was enough to convince the mice they had in fact been shocked there before, though, they had not.

According to Joel N. Shurkin with the news service "Inside Science," these false memories are as powerful and seemingly real as actual memories. At the same time, it is worth considering whether a human, with greater awareness and context than a mouse, would somehow be less easily convinced by the implantation of false memories. Still, this process reveals how easy it is to toy with the idea of "reality."

This experiment and its conclusions further the understanding of specifically how and where memory formation occurs in the brain. Norwegian scientist Dr. Edvard I. Moser, who was not involved in the experiment but commented on it later for the *Times*, said this is the closest we have ever come to being able to point to a specific part of the brain and say it is responsible for memory.

Additionally, the ability to plant and further understand memory formation and how easy it is to create false memories, helps us understand that memory is actually a very unreliable tool. This is useful for humans to know as memory is used in many different ways, including witness testimony in court cases. In fact, witness testimony relies entirely on a person's ability to remember events.

Shurkin quotes a statistic from an organization called the Innocence Project to highlight how serious this matter is when it comes to court testimony:

“...eyewitness testimony played a role in 75 percent of guilty verdicts eventually overturned by DNA testing after people spent years in prison. Some prisoners may have even been executed due to false eyewitness testimony. It was not because the witnesses were lying.”

In fact, the witnesses were just wrong without even realizing it. Someone who is convinced of a false memory believes it entirely to be true. This new information has the potential to forever change how we understand eyewitness testimony and general court proceedings.

While it may be scary to consider how unreliable our memories can be, researchers agree there is certainly a plus side to this new research. According to the authors of the study, “this type of research could one day help treat some emotional problems, such as post-traumatic stress disorder (PTSD), which involves the intrusion of unwanted memories.” The ability to play with humans’ memories gives us much more power over the way we think and cope with painful memories, and could be key in helping people who suffer from a range of emotional problems.

Scientists have also long wondered why false memory creation is so easy in humans in the first place. Why are humans’ memories so prone to failure? Gorman noted in the *Times* the ability for the brain to be flexible and imagine different scenarios could be responsible for a great deal of human creativity.

However, this creativity—or, the “imagination”—is unique to humans and is a big part of what makes us human. Unless animals are subjected to false memory experiments like the mice at MIT, they do not create false memories the way humans do.

Recall

11

Comprehension Questions

(circle the best answer)

1. What did scientists at MIT accomplish in a recent study?
 - A They convinced humans to remember images inaccurately.
 - B They planted false memories in humans.
 - C They planted false memories in mice.
 - D They proved that planting false memories only happens in movies.

2. What does the author describe in the passage?
 - A a scientific study of false memory formation and its effects
 - B a guide to planting false memories in mice
 - C technological advances that have furthered our understanding of memory
 - D the role of imagination in false memory formation

3. Scientists successfully gave mice false memories of being shocked in a certain location. Which evidence from the text supports this conclusion?
 - A Scientists stimulated the area of the mice's brains that were activated in the first location.
 - B The mice were allowed to explore the first location in peace.
 - C The mice received shocks in the second location.
 - D The mice were afraid of the location where they had not been shocked.

4. Why is an understanding of memory formation in mice important for humans?
 - A It allows scientists to develop cures for mice suffering from memory problems.
 - B It allows scientists to create technologies that can create false memories in animals.
 - C It allows scientists to better understand memory formation in humans since it is similar to memory formation in mice.
 - D It allows scientists to conduct more experiments where they can convince mice of false memories.

5. What is this passage mainly about?
 - A how scientists can plant false memories in mice
 - B how scientists are learning about false memory formation and why this is important
 - C the reasons why false memory formation occurs in humans
 - D the failure of scientists to understand false memory formation

6. Read the following sentence from the passage: "According to the authors of the study, 'this type of research could one day help treat some emotional problems, such as post-traumatic stress disorder (PTSD), which involves the **intrusion** of unwanted memories.'"

As used in the passage, what does "**intrusion**" mean?

- A invasion
- B surprise
- C retreat
- D introduction

7. Choose the answer that best completes the sentence below.

Animals are not capable of imagination; _____, they do not create false memories independently.

- A meanwhile
- B consequently
- C however
- D obviously

8. What did the MIT study on mice teach scientists about memory formation?

9. The unreliability of memory is a serious problem when it comes to witness testimony. What evidence from the text supports this conclusion?

10. Explain the potential effects the study of memory formation could have, using at least one example from the text.
