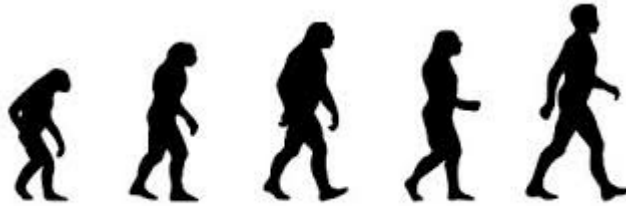


THE LEAKEY FOUNDATION Episode 07: The Currant Bush of Life
with Bernard Wood

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THE LEAKEY FOUNDATION

Origin Stories Episode 07: The Currant Bush of Life with Bernard Wood

Meredith Johnson

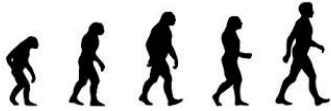
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This is Origin Stories, the Leaky Foundation podcast. I am Meredith Johnson.

A few years ago, I heard a talk called *Relatives and Ancestors* by Bernard Wood. It was so interesting and funny. I got curious to learn more about him and his work. Wood is a medically trained paleoanthropologist and University Professor of Human Origins at the George Washington University. He is one of the people other scientists turn to when they have found a new fossil and they need to figure out how it might be related to us. That is because one of his academic specialty is reconstructing phylogeny—figuring out the relationships between living things. He spent decades working on understanding the connections between us and everything else in the primate family tree. So, when some of you asked for a sort of a refresher course in human evolution, it felt like the perfect chance to talk to him.

Bernard Wood

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Human evolution in five minutes. I think you could argue that one of the most important pieces of evidence about human evolution, which has emerged in the last quarter of a century, has absolutely nothing to do with fossils. It is to do with the fact that molecular biologists have now come up with really convincing evidence that the apes that are most closely related to modern humans are chimpanzees and bonobos. That, I think, is really very secure.

Meredith Johnson

We share nearly ninety-nine percent of our DNA with chimps and bonobos, which means we clearly share a common ancestor with them. Wood says most estimates are that our common ancestor lived five to seven million years ago.

Bernard Wood

Human evolution is what occurred between that hypothetical common ancestor of modern humans and chimpanzees and bonobos and the present. And so, if I get asked at a party what do I do, that is what I say. I am interested in what happened between that hypothetical common ancestor and modern humans.

Meredith Johnson

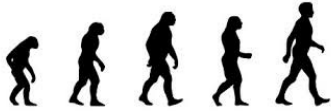
So, if you want to plot out what happened in human evolution and understand the relationships between all the creatures that ever lived, one way is by looking at what we call the tree of life.

Bernard Wood

00:02:27 If you think of the tree of life—if you think of a sort of a three-dimensional tree, which one of Darwin's major contributions was suggesting that all living creatures were related like the branches on a tree.

Meredith Johnson

It is a really elegant image that Charles Darwin first sketched out in the mid-1800s. The idea that all life is genetically connected like branches in a tree, reaching back to a common root is a really wonderful metaphor. So, imagine a tree. Everything alive today is on the surface of the tree, like leaves at the tips of the branches.



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Bernard Wood

The surface of the tree contains all living organisms. And the branches within the tree are either leading to those living organisms, because every living organism can trace itself back to the base of the tree, or they represent organisms which are extinct, because they did not make it onto the surface of the tree. Modern humans made it onto the surface of the tree and chimpanzees and bonobos did and lowlander mountain gorillas and orangutans from Borneo and Sumatra.

Meredith Johnson

But the common ancestor we share did not make it.

Bernard Wood

Now, the logic is that the only branches that you have to have in the tree are the ones that lead to the surface, because every animal alive today has to have ancestors.

Meredith Johnson

Wood says you could argue that the only thing you are going to find in the fossil record is a series of ancestors, going from us at the tip of the branch, back and back, getting more and more primitive as we get closer to the base of the branch.

Bernard Wood

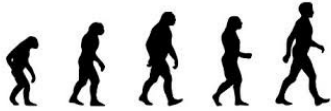
Maybe Neanderthals were our ancestors, and then Homo erectus was the ancestor of Neanderthals, and Australopithecus of Homo erectus, and some more primitive form of Australopithecus, and so on and so forth, until you get back to the hypothetical common ancestor.

Meredith Johnson

But if you look at the rest of the animal kingdom, at their branches in the tree, you will see that the branches that do not lead to living creatures vastly outnumber the ones that do.

Bernard Wood

So, you could say, "Well, if that is the case, then why should our part of the tree of life be any different than the rest of the tree of life?" You could argue that instead of assuming that every fossil or creature you find is an ancestor, you could argue it is a close relative and not an ancestor.



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Meredith Johnson

So, not every hominid fossil we find on the ground was necessarily one of our precursors.

Bernard Wood

And when I give talks about this, I show two pictures.

Meredith Johnson

One is a picture of his great-grandparents' fiftieth wedding anniversary.

Bernard Wood

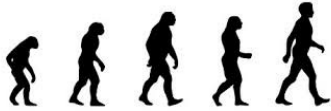
My father is in the picture; his mother is in the picture; his father is in the picture; his grandparents are in the picture. And there is only one person in the picture who is not one of my ancestors and it is my Aunt Kitty. And she was a lovely person, but she was not necessary for my existence. She was necessary for her descendants' existence, but she was not necessary for my existence. So, that is an example where ancestors outnumber close relatives who are not ancestors, so non-ancestral close relatives. I also show a picture of my christening. The close relatives, they outnumber the ancestors. And the question is: Is our evolutionary history more like the golden wedding picture or is it more like the christening picture? My sense is that it is rather more like the christening picture. In other words, I think there are certainly, from four million years until fifty thousand years ago, or maybe even more recently, there was always evidence of more than one lineage. You only need one lineage to connect us back to the common ancestor of us and chimpanzees and bonobos. But at almost every stage we looked at, I think there is pretty good evidence of more than one lineage.

Meredith Johnson

So, Bernard Wood says you can either think of our evolutionary history like a ladder, with a series of ancestors and descendants leading to modern humans, or you can imagine that it is more like a bush—more like a fruit bush.

Bernard Wood

A blackcurrant bush or redcurrant bush or some other currant bush.



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Meredith Johnson

With lots of branches leading up to the surface, but ours is the only branch that actually made it. Figuring out how all these branches on the phylogenetic tree of life should connect is tricky business and we are finding lots of possible new relatives all the time. The fossil record shows that even pretty recently, there were several kinds of humans living at the same time. If you look back, say just fifty thousand years ago, you would see several kinds of creatures that are clearly our relatives.

Bernard Wood

There were modern humans; there were Neanderthals; there were probably late surviving Homo erectus; there was the Denisovans, which is just known from a few fossils from a cave in mainland Asia or in Russia. The molecular biologists say that there is a ghost lineage as well, so there is probably another lineage for which we do not have any fossils; and there is Homo floresiensis. And so, it is not that long ago there would be more than one living representative of the hominin clade. So, the fact that there is only one now, slightly misleads us about how busy and complex was our evolutionary history.

Meredith Johnson

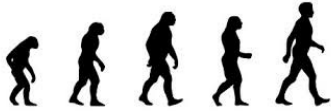
I asked Wood exactly how paleoanthropologists figure out which of these fossil relatives might be our ancestors. He said they usually start by comparing the morphology—the form and structure of an organism.

Bernard Wood

You do this by making the assumption that the more morphology two species share, the more closely related they are, which is a perfectly reasonable principle. The only problem is that evolution is sort of lazy. The same things, if they do a good job for one animal, are likely to do a good job for another animal.

Meredith Johnson

So, the same solution to an environmental challenge or food source opportunity might evolve in different contexts.



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Bernard Wood

And so that means that shared morphology does not always mean shared recent evolutionary history. It might mean shared environments and a shared evolutionary response, adaptive response to those environments. And so, for example, you could assume that every early hominin that has large chewing teeth, inherited those large chewing teeth from a recent common ancestor. My instinct is that large chewing teeth have evolved several times in the course of human evolution, of hominin evolution.

Meredith Johnson

Color vision is another example. Most, if not all, primates have some form of color vision.

Bernard Wood

You would have thought that having a system in your eye that allowed you to distinguish color was such a complex change in your retina that it is racingly unlikely that this would have occurred more than once. I do not know the literature, but my memory is that there is molecular evidence that color vision has probably evolved independently three or four times in the primate clade.

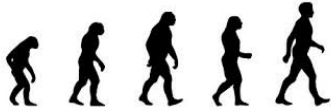
Meredith Johnson

Wood says he thinks adaptations like large chewing teeth and upright walking may have evolved multiple times over the course of evolution, in hominins that are not each other's ancestors. This makes his work of figuring out who is a relative and who is an ancestor and drawing the lines on our family tree pretty challenging, to say the least.

Bernard Wood

There have to be lines. There has to be a natural phylogeny. And so, I have to try and think of ways that one can try and get around the problem of shared morphology, not meaning shared recent evolutionary history.

Meredith Johnson



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So, Bernard Wood thinks it is critical not only to find more fossils, but to try and get more information from the fossils we have and to look at them in different ways, to find parts that might give new clues to their place on the tree of life.

Bernard Wood

You can obviously increase the evidence base by finding more fossils, but you can also increase the evidence base by finding out more things about the fossils that you do have. There are methods like CT scanning. There are imaging methods, which are allowing us to collect evidence from fossils that just was not accessible before. So, for example, if you take the work of Brad Spaw, who has been looking at the bony labyrinth, which is the series of canals in the very hardest part of your head where the inner ear is, he can look at the shape and the proportions of these canals using CT scanning. Now, those canals were always there in those fossils, but they were inaccessible. So, imaging allows you to increase the evidence base.

Meredith Johnson

00:12:04 And as the work goes on, finding and analyzing new evidence, and trying to figure out just who is a relative and who is an ancestor, we still need to organize our family tree somehow.

Bernard Wood

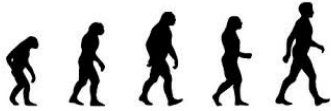
When I talk about human evolutionary history, I show the taxa; I show the species that are recognized in the fossil record; and I show the earliest fossil evidence at the bottom of the column and the latest fossil evidence at the top of the column; but I never put any lines on the diagram. And that is because, with one or two exceptions, I think we are not really certain whether we have found the ancestors of many of the taxa on that diagram.

Meredith Johnson

Those ancestors may be something that has not been discovered yet.

Bernard Wood

When I was younger, I used to stress how much I thought we knew. The older I get, I tend to stress how much we do not know. And when you think that the Rift Valley were all the fossil sites, including Olduvai and Hadar and Middle Awash and all the way down to Malawi and the fossil sites in Southern



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Africa and the fossil sites in Chad, if you look at the surface area of Africa that those sites occupy, it is probably less than four percent of the surface area of Africa. And if you think that the good Lord, in her wisdom and magnanimity, has made sure that the fossils that we find in the Rift Valley and in the Southern African Cape sites capture every little intricacy of human evolution, then you are more of an optimist than I am. So, I would go for complexity over simplicity. And I would go for skepticism about what was ancestral to what, rather than confidence about what was ancestral to what.

Meredith Johnson

What started as a simple little ink sketch in Darwin's notebook has grown to hold the history and relationships of everything that has ever lived, billions of organisms represented in one amazing image. And as we have continued to fill it in over the past 150 years, our little section of the tree is getting more interesting all the time.

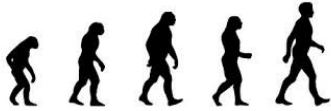
Bernard Wood

Human evolutionary history is an area where, I think, more information might help folks behave better. It might help individuals behave better to realize that every modern human is African. No matter what they look like, they came from Africa. Although some people have pigmented skin and some people do not have pigmented skin and some people have wiry hair and some people have straight hair, you are probably as likely to be genetically more different than the person that lives next door to you, than you are somebody from the other side of the world. And this sort of information, I think, would help people make better decisions. The more we find out how life is interconnected, the less likely we are to screw the world up. That is my hope. Whether that hope will ever be translated into results, I do not know, but that is my hope.

Meredith Johnson

You can hear more from Bernard Wood in his book *Human Evolution: A Very Short Introduction* and on his blog "Sideways Look". We will have links in the show notes.

"Origin Stories" is a project of The Leakey Foundation. The Leakey Foundation is working to fill in our part of the tree of life by funding research and fieldwork expeditions. You can help support this podcast and the science we talk about. For a limited time, your donation will be doubled by an anonymous supporter. Visit leakeyfoundation.org/million. That is L-e-a-k-e-y foundation.org.



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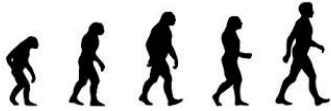
This episode was produced by me, Meredith Johnson. Our editor is Audrey Quinn. Original music and sound engineering by Henry Nagel.

The Leakey Foundation logo of the marching men is an iconic representation of human evolution. People sometimes ask why it has not evolved as more evidence is found; why it does not show more of a bush than a ladder You can learn more about the history of this logo by visiting our website leakeyfoundation.org. Thanks for listening.

Transcript and pre-production transcript by AdeptWordManagement.com.

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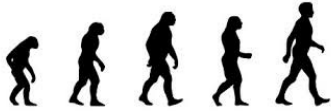
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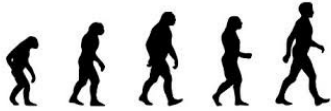
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