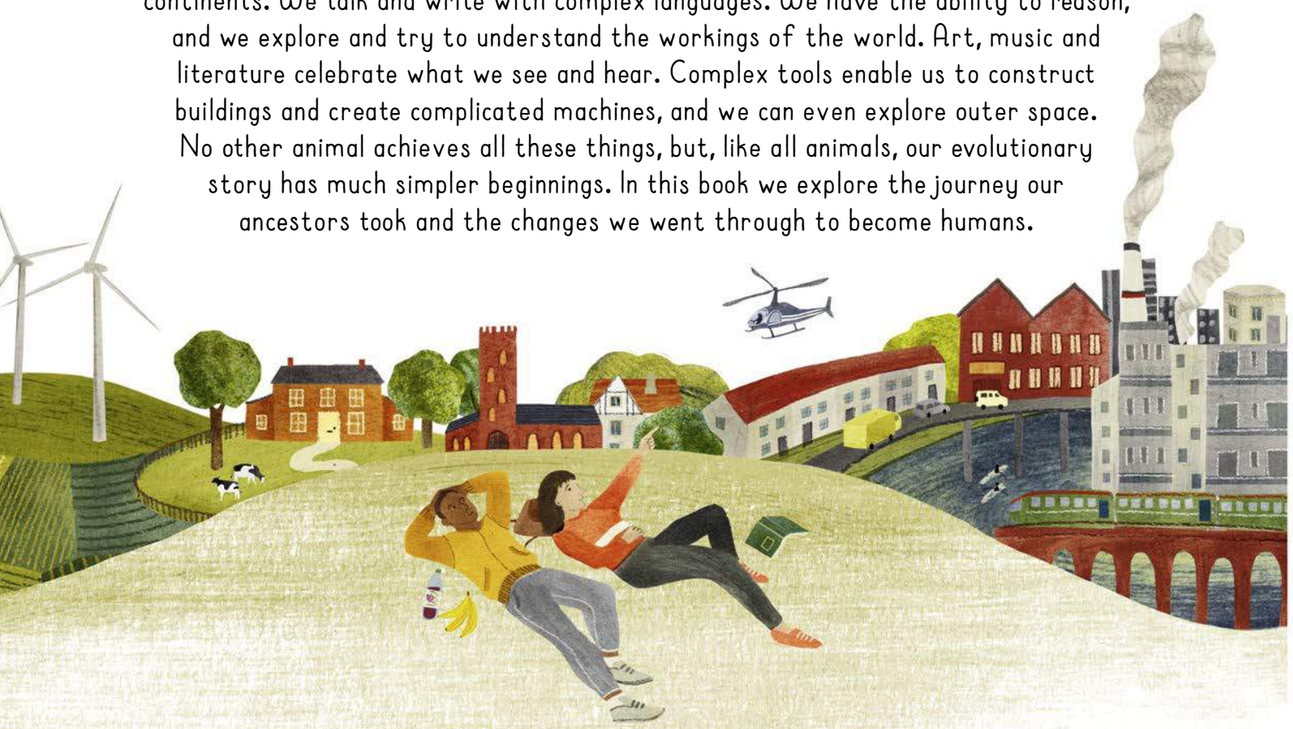
WHAT'S A HUMAN?

Humans are unique. We grow crops, breed domestic animals and trade across continents. We talk and write with complex languages. We have the ability to reason, and we explore and try to understand the workings of the world. Art, music and literature celebrate what we see and hear. Complex tools enable us to construct buildings and create complicated machines, and we can even explore outer space. No other animal achieves all these things, but, like all animals, our evolutionary story has much simpler beginnings. In this book we explore the journey our ancestors took and the changes we went through to become humans.



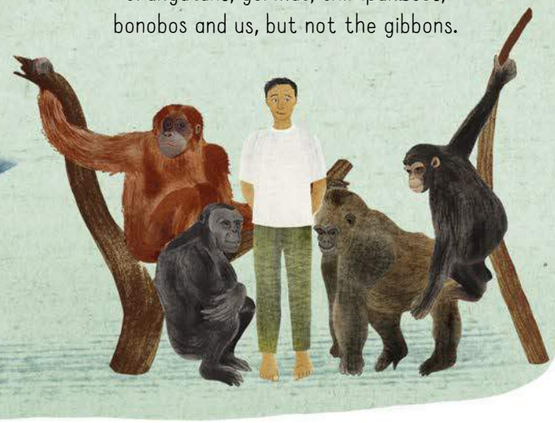
So where exactly do humans fit in?

Hominins

And, just when you thought scientists had invented enough words to describe humans, there's another one. Humans and our closest relatives are called hominins.

Hominids

Humans are also included with the hominids, or great apes. This is a subgroup of the apes that includes orangutans, gorillas, chimpanzees, bonobos and us, but not the gibbons.



Haplorhines

Humans are haplorhines, meaning 'simple noses', a group which includes monkeys and apes. One difference between monkeys and apes is very obvious: most monkeys have tails but apes do not, which, if you look in the mirror, makes us an ape.

Primates

Humans are primates. This is a subgroup of mammals that includes lemurs and lorises on the one hand and tarsiers, monkeys and apes (including humans) on the other.

Mammals

Humans are mammals. Like all mammals, humans have hair and human babies drink their mother's milk. It contains all the goodness that a growing human baby needs.

What's in a name?

The scientific species name for modern humans is *Homo sapiens*, meaning 'wise human being'. In biology, most living things have a two-word name. In this case, *Homo*, meaning 'human', is the genus name, and *sapiens*, meaning 'wise', is the specific name. In the following pages, you will find the two-word names of several of our ancestors, although some will just have the genus name so the words are less of a mouthful.

SMALL BEGINNINGS

The earliest primate fossils are about 65 million years old, and those animals evolved from primate-like creatures that were living when dinosaurs ruled the Earth. They were small and kept out of the way of dinosaurs by living in trees.

Asteroid impact!

About 66 million years ago, an asteroid hit the Earth and three-quarters of the world's wildlife became extinct, including the dinosaurs. It also meant that a quarter of life survived. Among the survivors were the early primates. With many of their competitors and predators gone, new species of primates evolved, and one of them was our direct ancestor.

Small bodies, big brains

Our earliest primate ancestors resembled modern tree shrews, tiny rodent-like mammals that scamper around in the tropical forest. Tree shrews have relatively large brain sizes for their bodies, so the early primates were probably pretty smart for their size.

PURGATORIUS

Pronounced: Perg-a-tor-ee-us
Lived: Cretaceous period – Paleocene epoch (66 mya)
Size: rat-sized, 15 cm long

This potential early primate survived the mass extinction and went on to live in the trees. It had ankle bones that could rotate and adjust the position of its feet, allowing it to grab branches easily. It was probably not a direct ancestor of humans, but our ancient relative would have looked and behaved like it.

Eyes front!

Like *Purgatorius* and modern tree shrews, our ancestors probably had eyes on the sides of their heads. These were good for spotting approaching predators. Later primates had eyes on the front of the head, like we have, providing the animals with a better way to judge distances. It gave them an advantage in finding food in the trees, and was especially useful for catching fast-moving insects.

ARCHICEBUS

Pronounced: Arch-ee-see-bus
Lived: Eocene epoch (55 mya)
Size: body 9 cm

Archicebus was tiny. It was smaller than the smallest living primate – Berthe's mouse lemur. Its eyes looked forwards. It possessed a long monkey-like tail, grasping hands, and its toes ended in flat nails, like we have, rather than claws. Scientists think it is probably not a direct ancestor to humans, but it looked a lot like one.

Vitamin deficiency

The primates that gave rise to humans lost a very important function. They could not make vitamin C, which means that we, as their descendents, can't either. It is something we share with modern guinea pigs, monkeys and other apes. The answer was to eat fruits, which are rich in vitamin C. It was our quest for fruit that, as you will see, helped shape the course of early human evolution.

AGE OF THE APES

Most of the earliest primate fossils have been found in Europe and Asia, but fossils from 30 million years ago show that, in Africa, monkey-like ape ancestors were beginning to look more like the apes we know today. Our distant ancestors were starting to look a little more like us, although they still lived in the trees where a key part of their diet was fruit.

Evolving together

Not all animals see in colour like we do, and that ability may have had something to do with fruit. Scientists have suggested that primates and fruit trees may have evolved together. The trees produced fruit that was increasingly more colourful and attractive as it ripened. Primates evolved the ability to see it in colour, reach for it, and pick it at the right time. Primates ate the fruit and dispersed the seeds in their droppings. The tree depended on primates and primates depended on the tree.

AEGYPTOPITHECUS

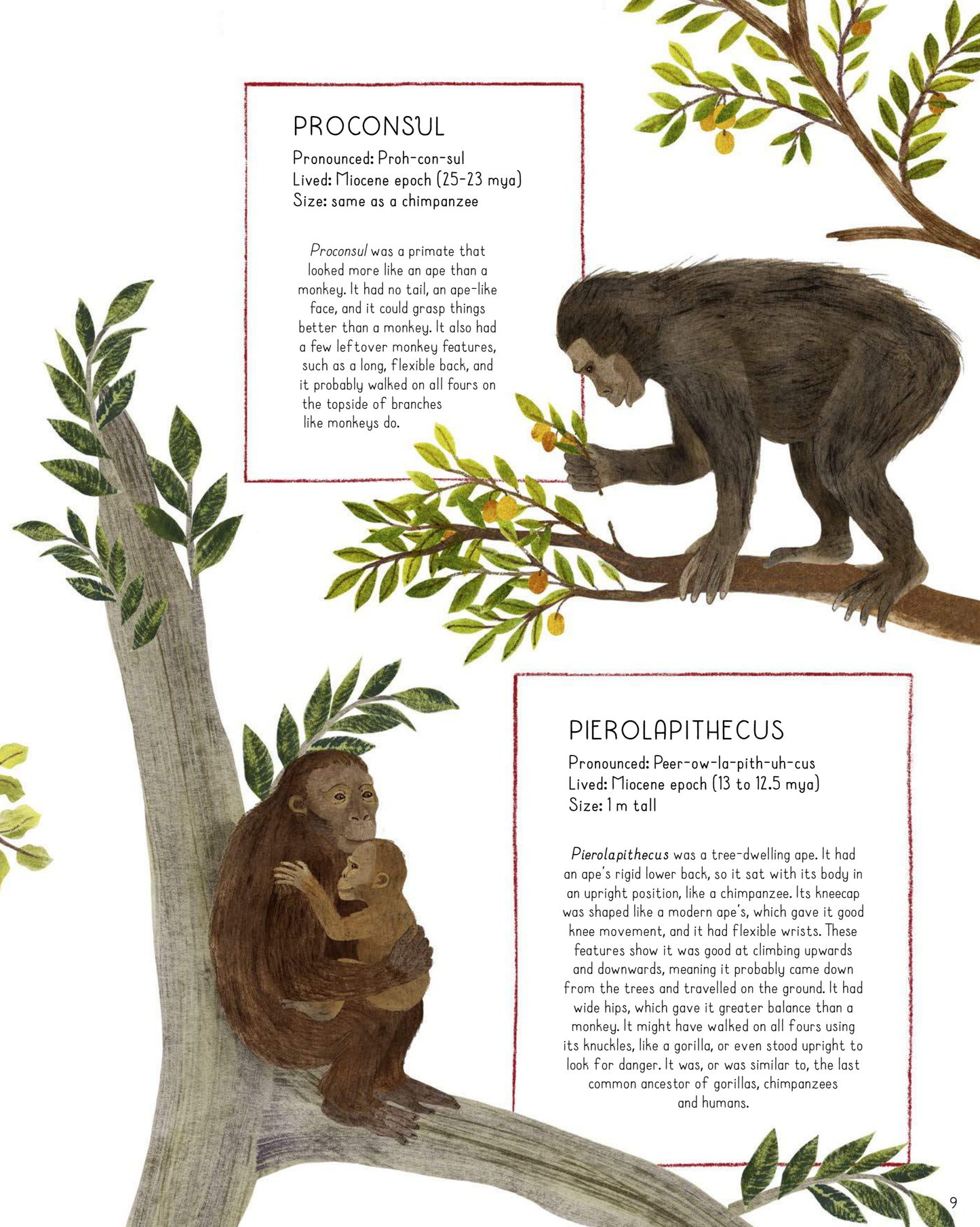
Pronounced: Ee-jip-tow-pith-uh-cus
Lived: Oligocene (30 mya)
Size: same as a modern howler monkey

This primate had features of both Old World monkeys and apes. It had a monkey's tail, but an ape's arm bones. It lived in large troops in the swamp forests of northeast Africa. Males had large, pointed canine teeth, so it is likely they fought to become the boss, like modern baboons.

PROCONSUL

Pronounced: Proh-con-sul
Lived: Miocene epoch (25–23 mya)
Size: same as a chimpanzee

Proconsul was a primate that looked more like an ape than a monkey. It had no tail, an ape-like face, and it could grasp things better than a monkey. It also had a few leftover monkey features, such as a long, flexible back, and it probably walked on all fours on the topside of branches like monkeys do.



PIEROLAPITHECUS

Pronounced: Peer-ow-la-pith-uh-cus
Lived: Miocene epoch (13 to 12.5 mya)
Size: 1 m tall

Pierolapithecus was a tree-dwelling ape. It had an ape's rigid lower back, so it sat with its body in an upright position, like a chimpanzee. Its kneecap was shaped like a modern ape's, which gave it good knee movement, and it had flexible wrists. These features show it was good at climbing upwards and downwards, meaning it probably came down from the trees and travelled on the ground. It had wide hips, which gave it greater balance than a monkey. It might have walked on all fours using its knuckles, like a gorilla, or even stood upright to look for danger. It was, or was similar to, the last common ancestor of gorillas, chimpanzees and humans.

HOW DO WE KNOW WHO OUR ANCESTORS WERE?

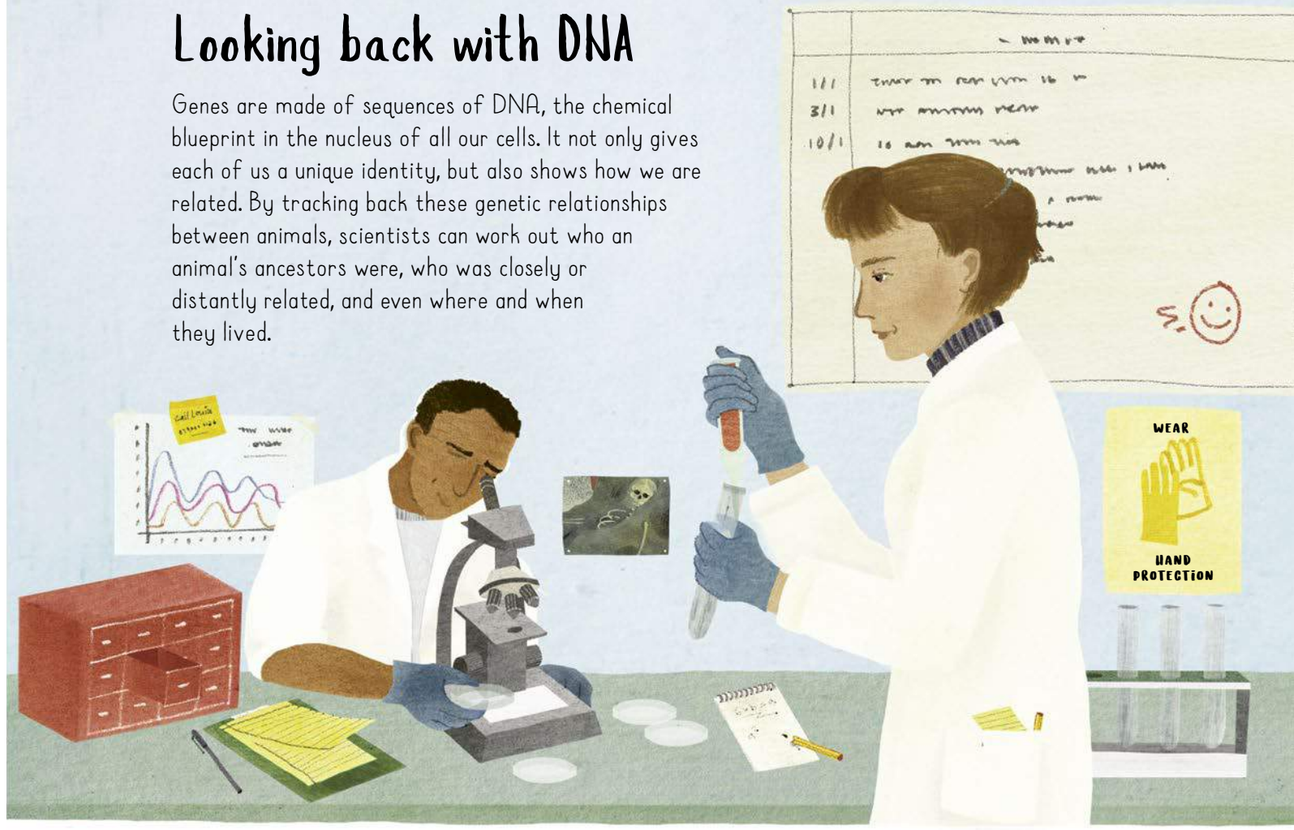
As pre-human primates lived many millions of years ago, their fossils are the main reason scientists know they existed. Fossils are the parts of plants and animals that have been preserved. They can be made in many ways. One way is to be buried in sediments, such as those on a lake bed. Over time, minerals replace the tissues, so fossils become like stone. Hard parts, such as bone, make for better fossils than soft parts, like brains. Tracks and burrows can also fossilise. They are known as 'trace fossils'. One way scientists know how old fossils are is by working out the age of the rocks in which they were found.

Brain size

In human evolution, the size of the brain is one indication of how smart its owner might have been. But, if brains don't fossilise, how do we know how big they were? The brain usually fits tightly into the space inside the skull so, using X-rays and CT scans, scientists can measure the size of the inside of a fossil skull. The size of the cavity gives an idea of the size of the brain.

Looking back with DNA

Genes are made of sequences of DNA, the chemical blueprint in the nucleus of all our cells. It not only gives each of us a unique identity, but also shows how we are related. By tracking back these genetic relationships between animals, scientists can work out who an animal's ancestors were, who was closely or distantly related, and even where and when they lived.



MEET THE RELATIVES

As all living things evolved from the same common ancestor, we share genes with every living thing on Earth, some more than others. We share 99.9% of genes with other modern humans, 96% with chimpanzees, 90% with cats, 85% with mice and about 60% with insects. You differ genetically by only 4% from chimpanzees and bonobos, making them your closest non-human relatives alive today.

Who was there?

Finding miniscule traces of DNA is helping scientists to determine what plants and animals were present in the places that feature in the human story. In a cave in Belgium, for example, there were no fossil skull fragments or other parts of a skeleton present, yet scientists were able to find minute amounts of DNA in the sediment of the cave floor – probably from blood, wee or poo – revealing that ancient humans had once lived there.

WALKING UPRIGHT

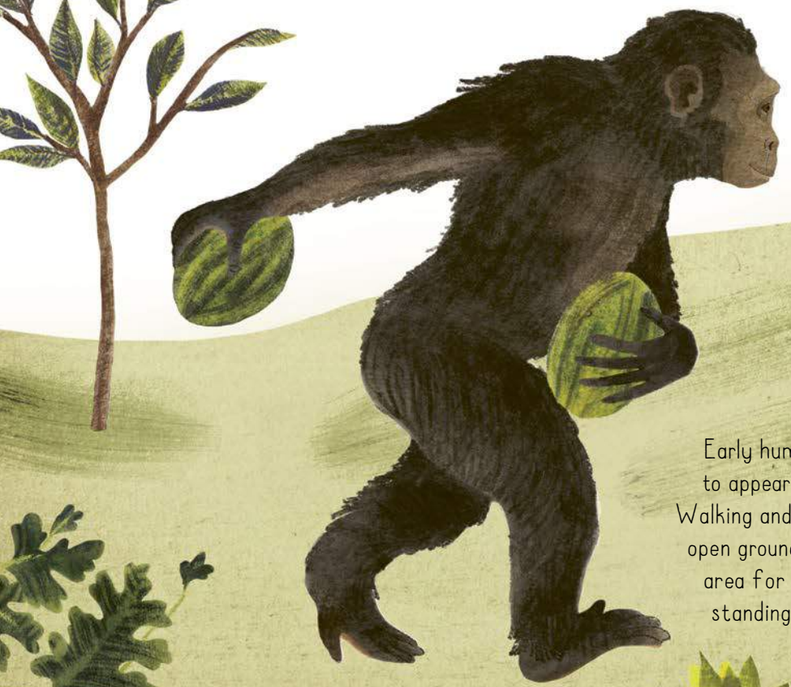
At some point between 8 and 6 million years ago, our nearest living relatives, the chimpanzees and bonobos, split away from our branch of the tree of life. It was a big moment in human history, for we were now hominins and on the branch that would lead directly to modern humans... but there were a few stages to go through first, such as walking upright.

Hips and knees

Chimpanzees and gorillas can walk upright, but they do so with bent legs. The joints at the top of the thigh bone and knee are such that they cannot stand straight on one leg, so they have to swing their body over when they raise their leg to walk, which makes them wobble from side to side. Nevertheless, they can walk upright and climb about in the trees. They bridge two worlds.

Why walk upright?

We don't know for sure, but it is generally said that our early ancestors stood up on two legs when they moved out of the forest and onto the grassy savannahs. This way, they could see further across the plains. All the early hominins, however, spent a good part of their lives in the trees, so there must be other reasons. One suggestion is that it has something to do with holding and carrying. By standing up, hominins had their hands free to hold tools, and carry food and even babies.



Other benefits

Early humans might have stood on their hind legs to appear bigger and more ferocious, like bears do. Walking and running also enabled early humans to cover open ground more easily, so they could search a wider area for sources of food, and on the hot savannah standing up exposes less of the body to the sun.

'ARDI' THE WALKER

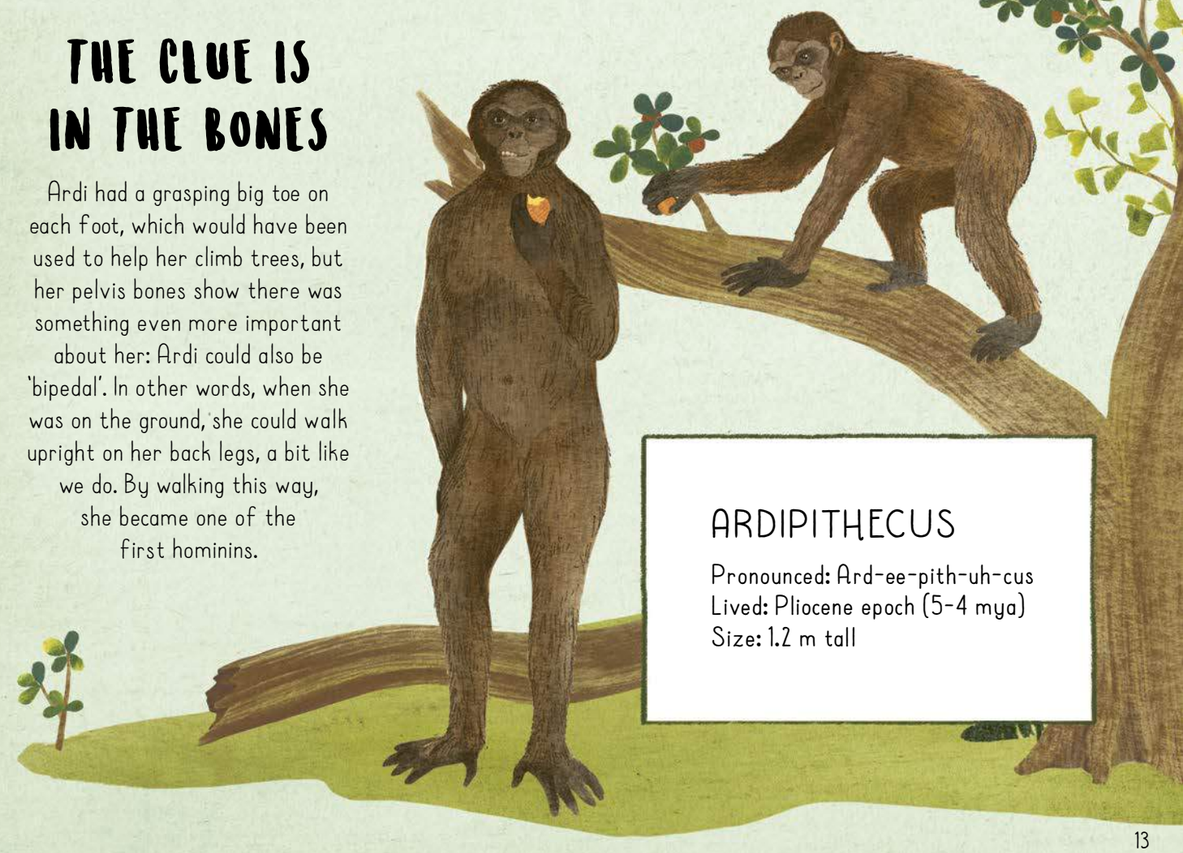
'Ardi' is the nickname of *Ardipithecus*, a primitive ape that showed ape-like and hominin-like features. The first Ardi fossils were of a female who was very much like a chimpanzee in size and stature. It indicates that our direct ancestor, who lived at about the same time, was also chimp-sized. Ardi had a smallish brain, even smaller than a modern chimpanzee's. She lived in woodlands in what is now Ethiopia.

STAY AT HOME DAD

Ardi had small teeth like a human. Even male canine teeth – the pointy ones either side of the front teeth – were small. This tells us that there was little aggression between males in *Ardipithecus* society. Where male primates fight, canine teeth tend to be long and fang-like. Ardi's small teeth have led one scientist to suggest that the non-aggressive males actually helped with the rearing of children, a key behaviour in later human evolution.

THE CLUE IS IN THE BONES

Ardi had a grasping big toe on each foot, which would have been used to help her climb trees, but her pelvis bones show there was something even more important about her: Ardi could also be 'bipedal'. In other words, when she was on the ground, she could walk upright on her back legs, a bit like we do. By walking this way, she became one of the first hominins.



ARDIPITHECUS

Pronounced: Ard-ee-pith-uh-cus
Lived: Pliocene epoch (5–4 mya)
Size: 1.2 m tall