

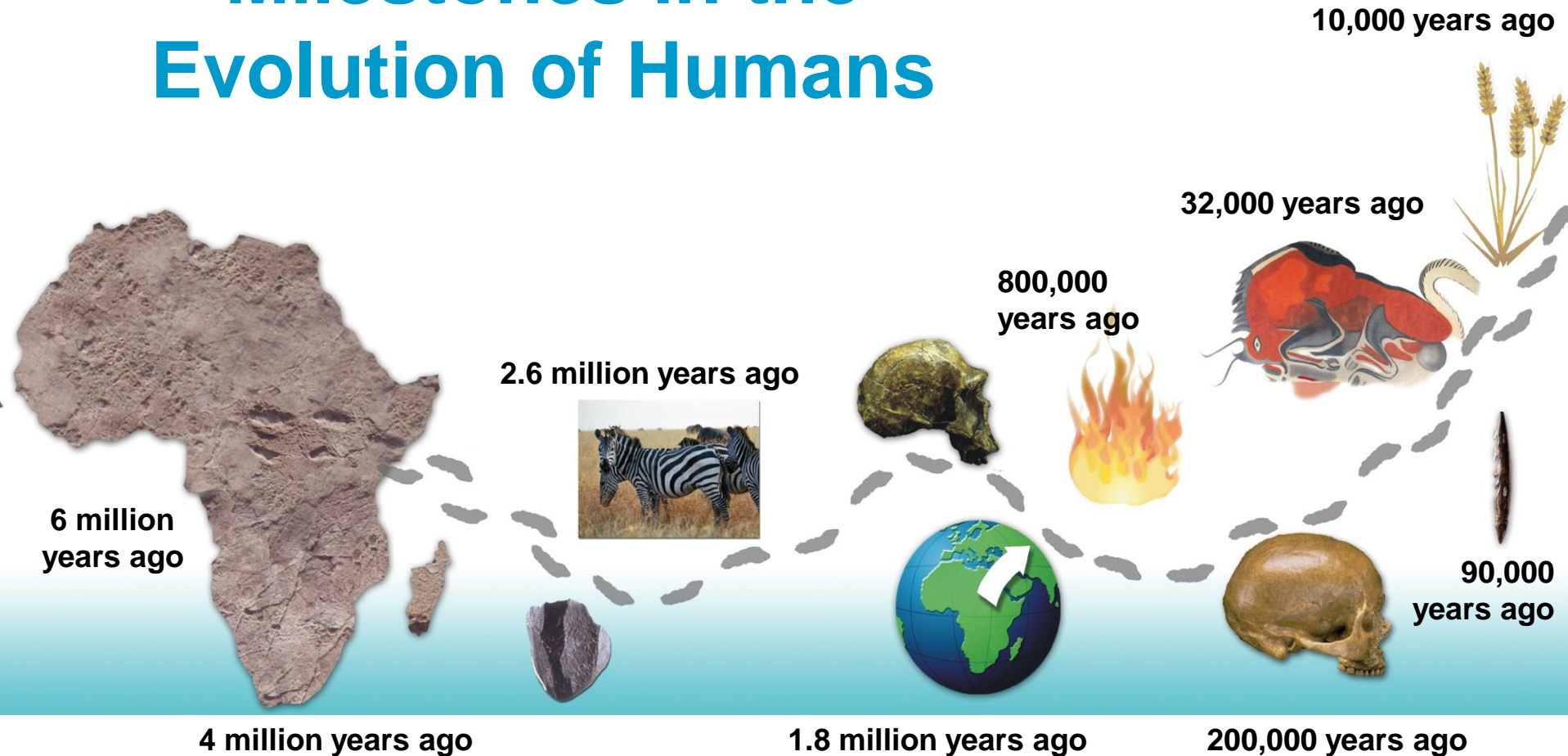
*Dr. Briana Pobiner
Smithsonian Institution*

“The human family tree: meet your ancestors”

February 3, 2014

*George Mason University
Osher Lifelong Learning Institute
Course: The History of Life, Part 2*

Milestones in the Evolution of Humans



Prosimians



Lemurs and Lorises



Tarsiers

Monkeys



New World Monkeys



Old World Monkeys

Apes

Great Apes



Lesser Apes



Orangutans



Gorillas



Chimpanzees and Bonobos



Humans

Today

Lemurs and Lorises

Tarsiers

New World Monkeys

Old World Monkeys

Lesser Apes

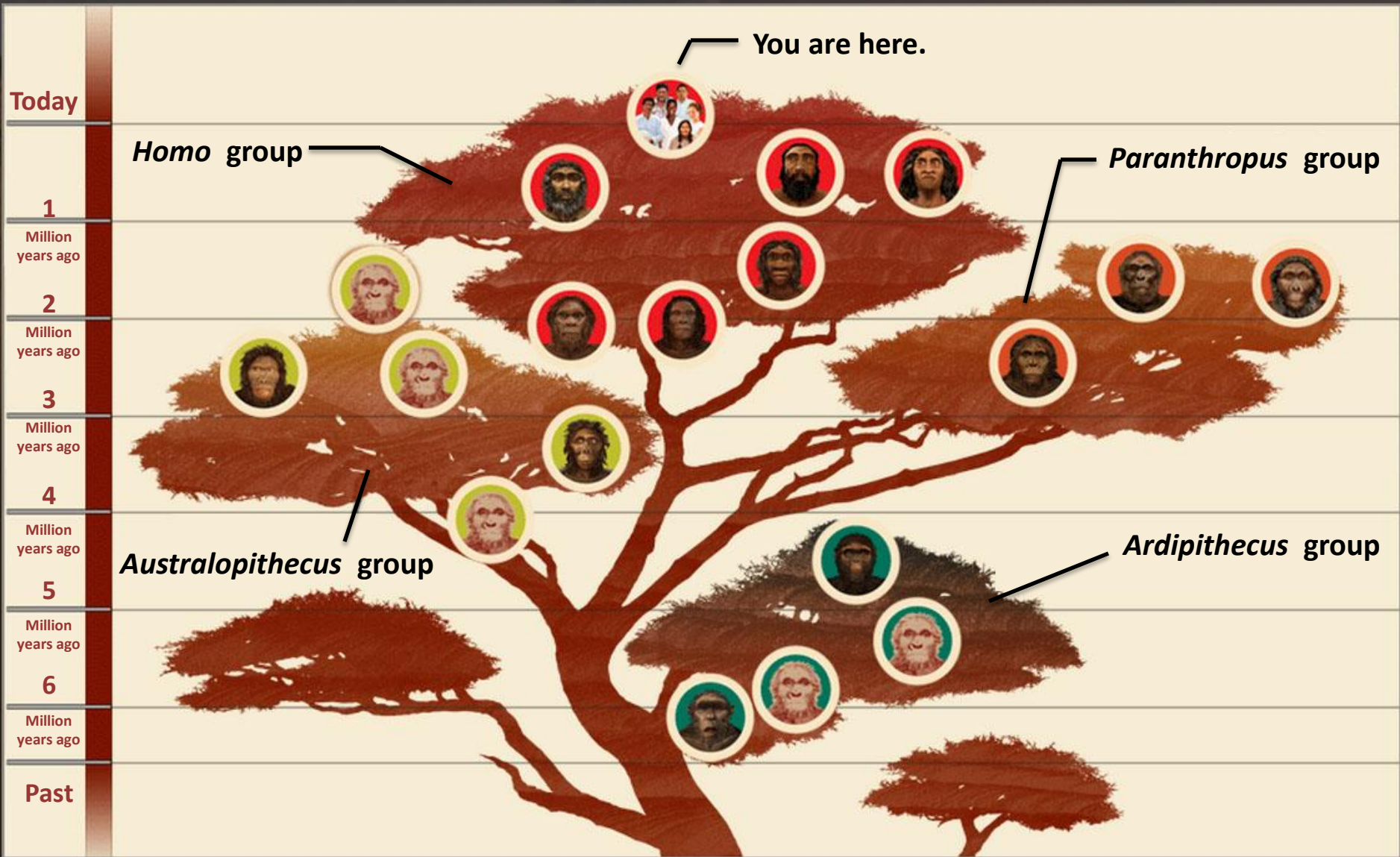
Great Apes

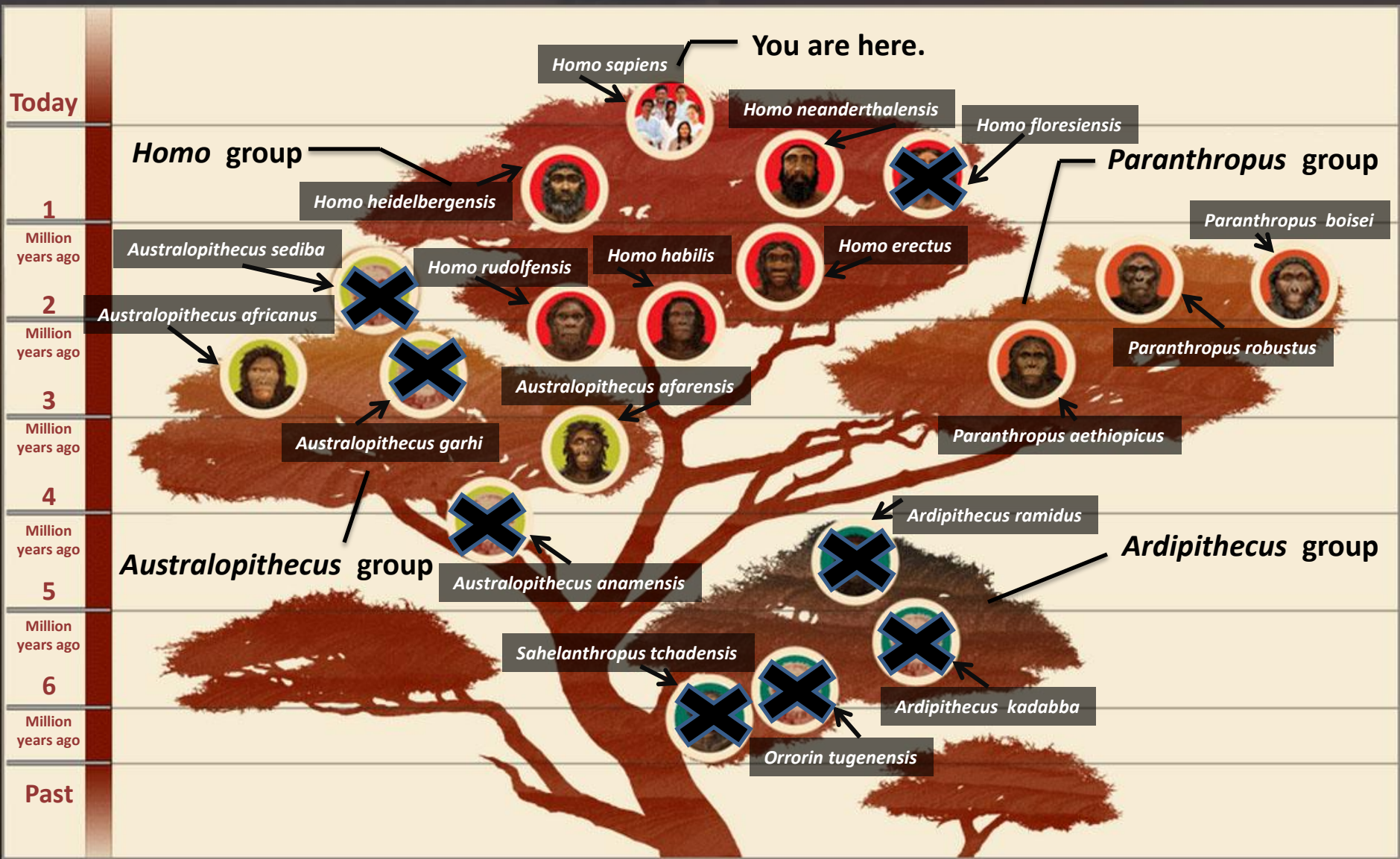
The last common ancestor of humans and living apes lived between 8 and 6 million years ago. We do not yet have its remains

The last common ancestor of monkeys and apes lived about 25 million years ago.

65

million
years ago





Today

1

Million
years ago

2

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years ago

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years ago

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years ago

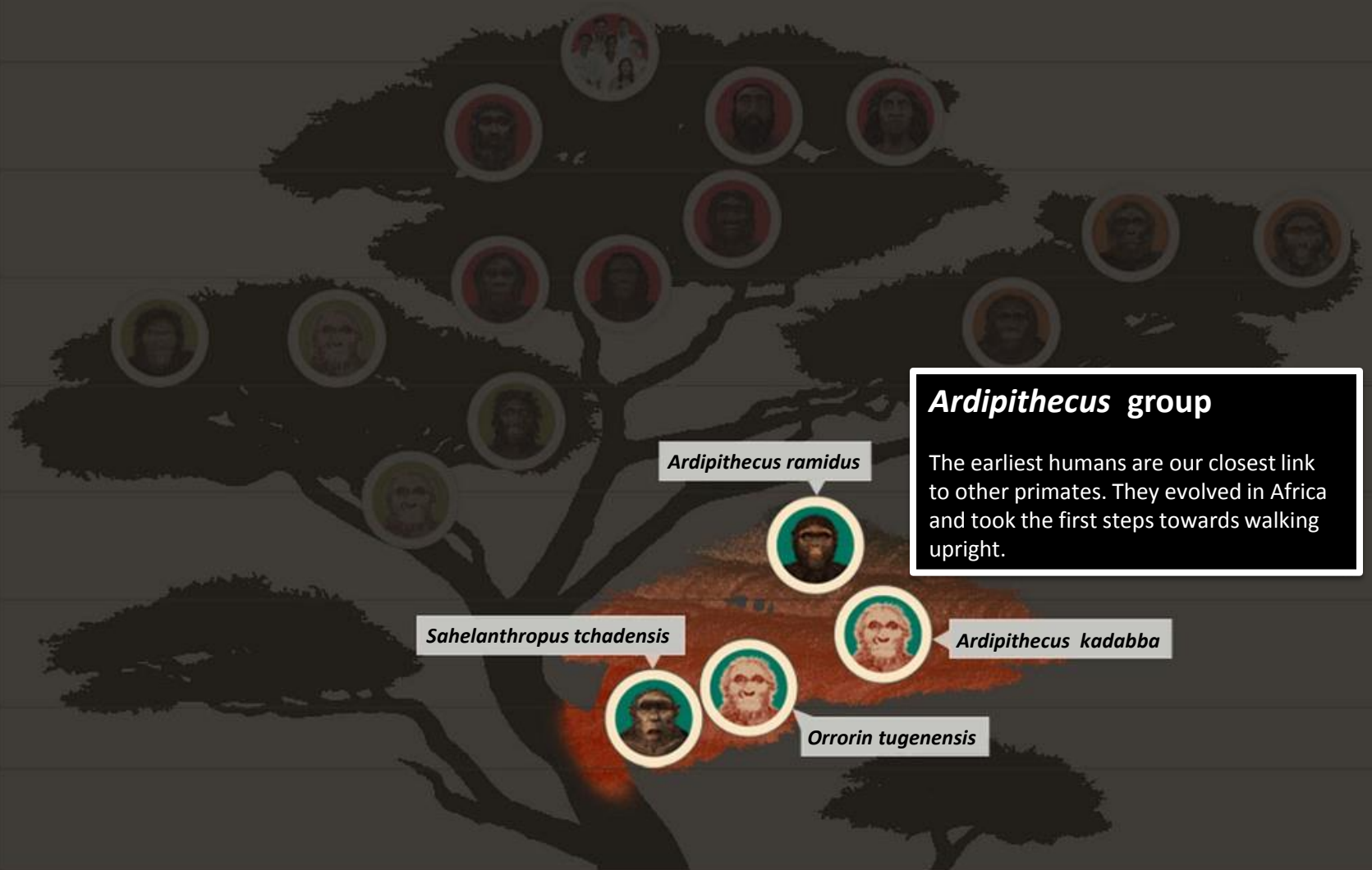
5

Million
years ago

6

Million
years ago

Past



***Ardipithecus* group**

The earliest humans are our closest link to other primates. They evolved in Africa and took the first steps towards walking upright.

Ardipithecus ramidus

Sahelanthropus tchadensis

Ardipithecus kadabba

Orrorin tugenensis

Sahelanthropus tchadensis

Name Means: Sahel ape-man from Chad

Nickname: "Toumai"

When Found: 2001

Who Found: M. Brunet

Lived When: sometime between 7-6 Ma

Lived Where: Chad, western Africa

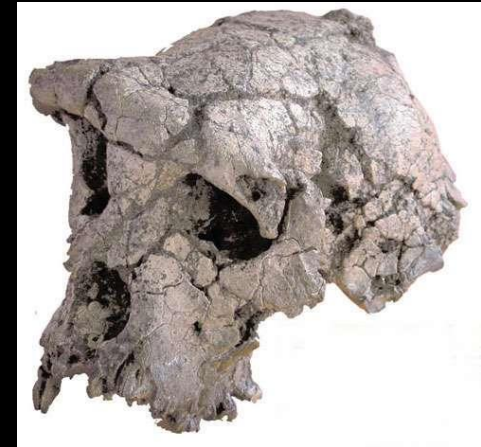
How Big? ~ chimpanzee (but no body fossils!)

Fossil Record: 1 skull, some jaw & tooth fragments

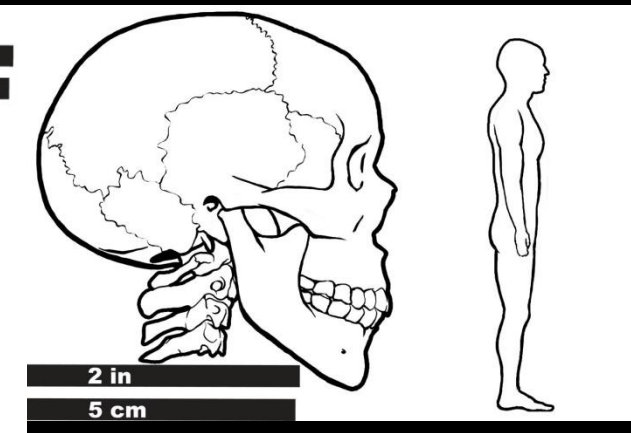
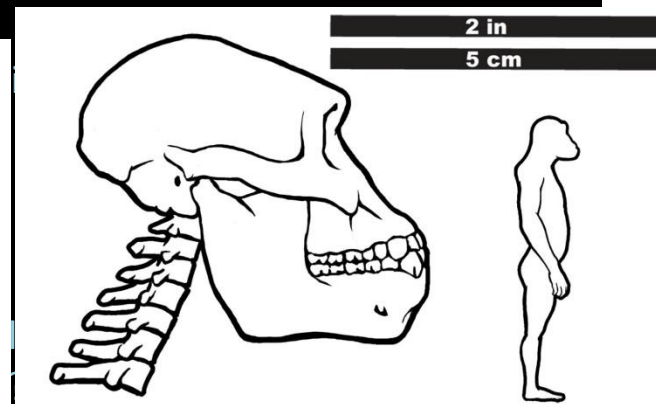
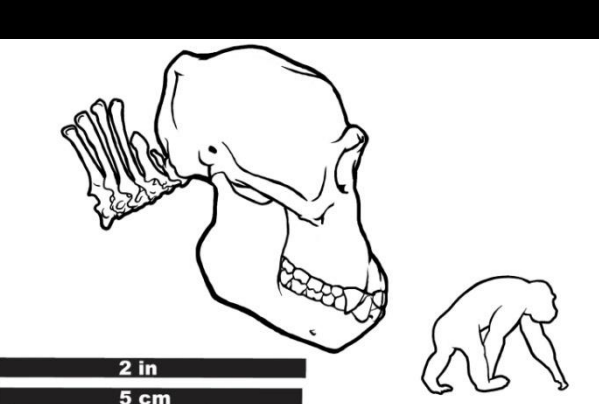
Basic Morphology: apelike: small brain, sloping face, very prominent brow ridges, and elongated skull; humanlike: small canine teeth, a short middle part of the face, and a

spinal cord opening beneath the skull

instead of towards the back



TM-266-01-060-1



Orrorin tugenensis

Name Means: original man in the Tugen region

Nickname: “Millenium Man”

When Found: 2001

Who Found: B. Senut & M. Pickford

Lived When: sometime between 6.2-5.8 Ma

Lived Where: Tugen Hills, central Kenya

How Big? ~ chimpanzee

Fossil Record: 13 fossils, 5+ individuals

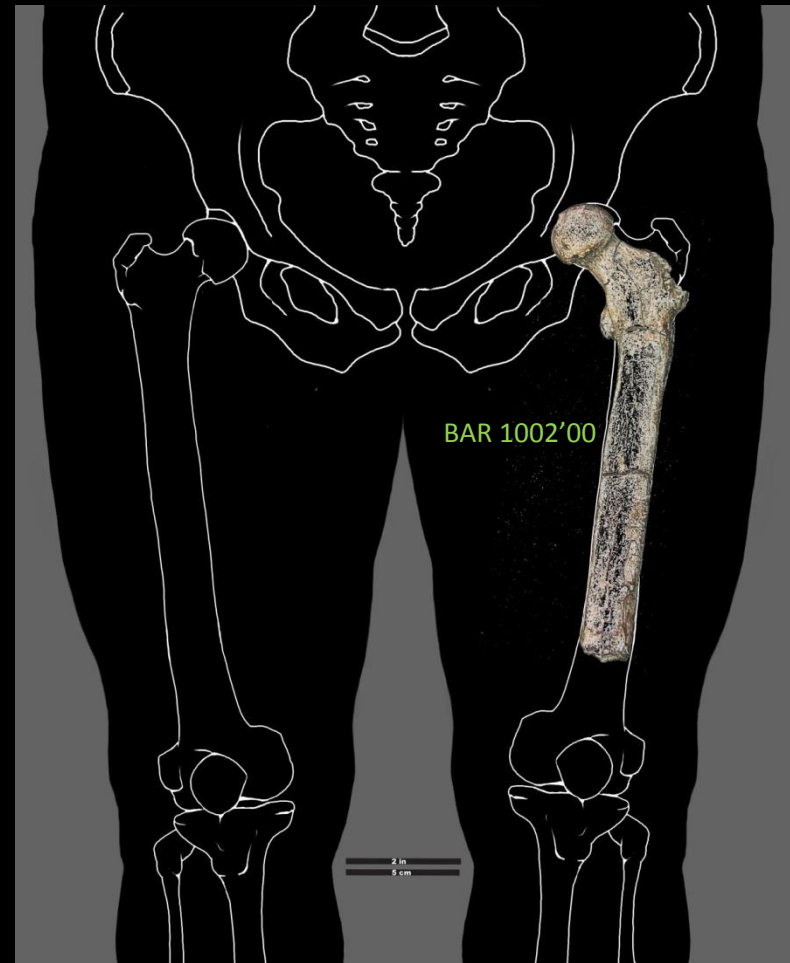
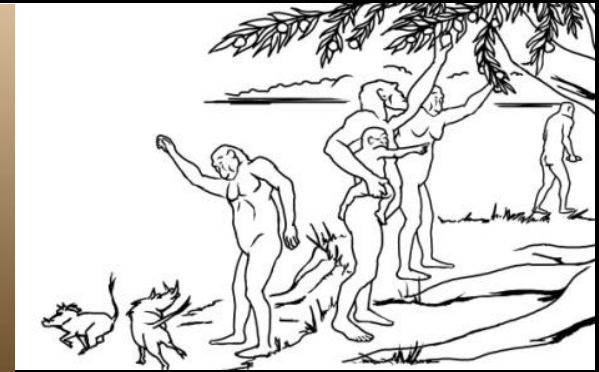
Basic Morphology: apelike long, curved finger bones and canine and premolar teeth, but

femur shows bipedal walking

Known For: Contender for earliest human

Burning Questions:

- Is it our direct ancestor?
- How often did it walk bipedally?
- How does it relate to *Sahelanthropus*?



Ardipithecus kadabba

Name Means: *Ardi* = "ground/floor"; *pithecus* is from the Greek word for "ape"; *kadabba* is from the Afar for "basal family ancestor"

Nickname: none

When Found: 1997 (2004 named to a separate species)

Who Found: Y. Haile-Selassie

Lived When: sometime between 5.8-5.2 Ma

Lived Where: Middle Awash Valley, Ethiopia

How Big? ~ chimpanzee

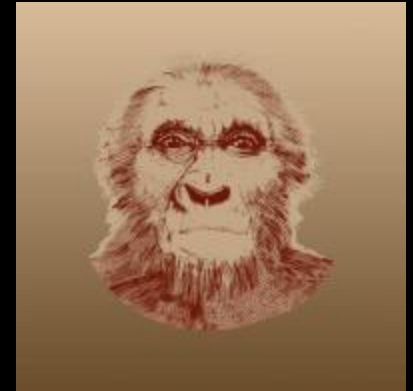
Fossil Record: 11 fossils, 5+ individuals; a few sets of teeth, some foot bones, partial arm bones, and a collarbone (clavicle)

Basic Morphology: **one bone from the large toe is broad and robust**, suggesting its use in bipedal push-off (5.2 Ma)

Known For: Contender for earliest human

Burning Questions:

- Was *Ar. kadabba* routinely bipedal? What was its gait like?
- Did bipedalism independently develop in the *Ardipithecus* lineage?
- Or is *Ar. kadabba* somehow related to *Orrorin* and/or *Sahelanthropus*?
- How is the *Ardipithecus* lineage related the *Australopithecus* lineage?



Ardipithecus ramidus

Name Means: *ramid* = "root"

Nickname: "Ardi"

When Found: 1992-1994; "Ardi" published in 2009

Who Found: T. White & team

Lived When: about 4.4 Ma

Lived Where: Middle Awash Valley and Gona, Ethiopia

How Big? (female) 3 ft 11 inches, 110 lbs

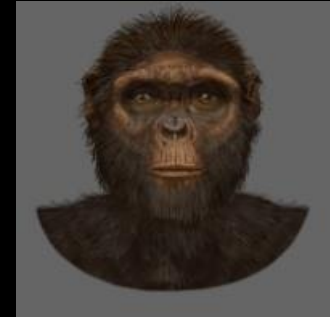
Fossil Record: >100 fossils; partial female skeleton "Ardi"

Basic Morphology: **divergent large toe** combined with a rigid foot; (crushed) **pelvis shows adaptations that combine tree-climbing and bipedal activity** (short & broad)

Known For: oldest partial skeleton; little male-female size difference (canine teeth); lived in a wooded environment

Burning Questions:

- Is it really an early human?
- What does the low level of sexual dimorphism mean?
- Is this species descended from *Ar. kadabba*? How is it related to us?



2 October 2009
Science



"Ardi"
ARA-VP-6/500

Today

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years ago

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years ago

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years ago

Past

Australopithecus sediba

Australopithecus africanus

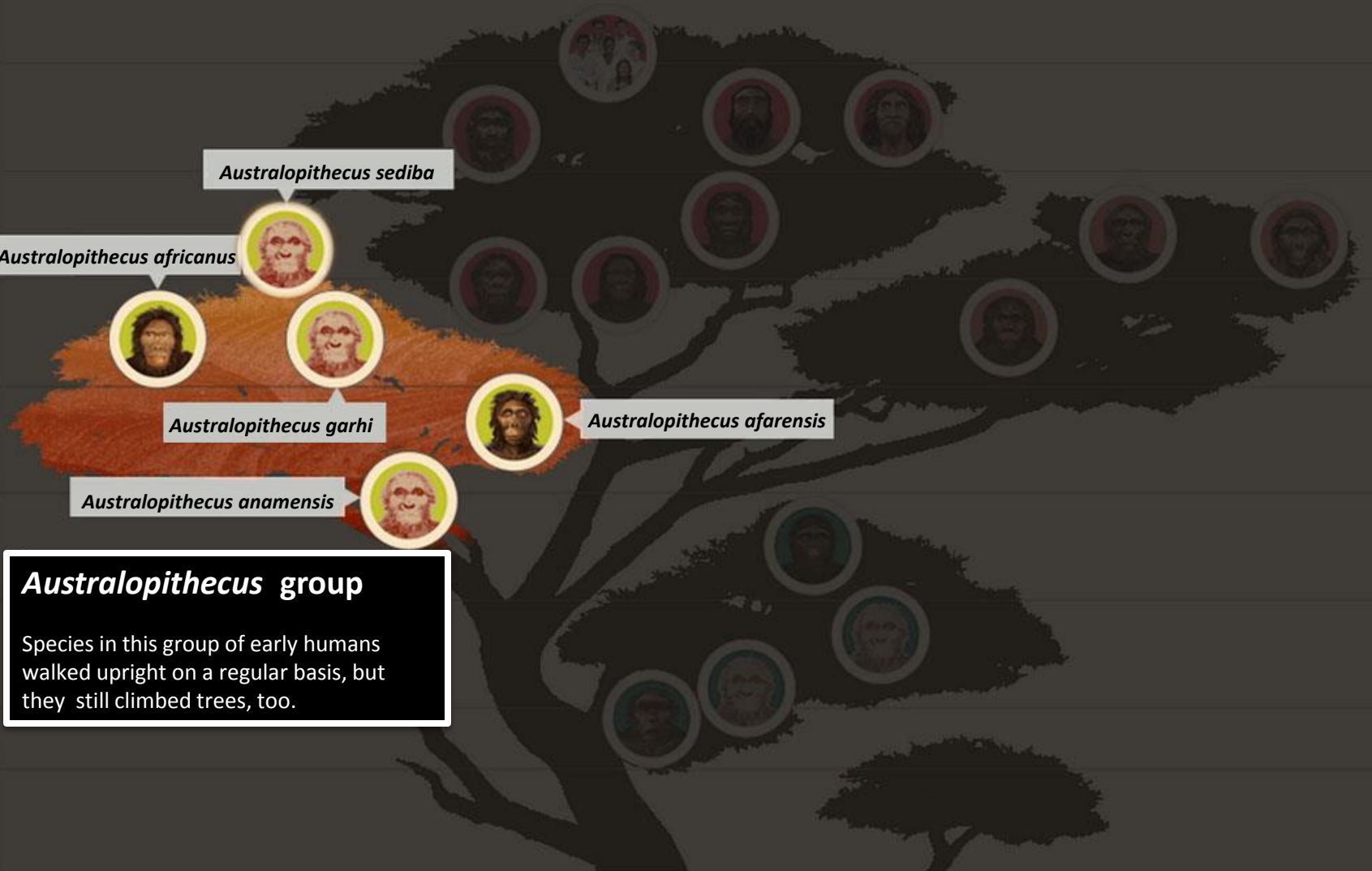
Australopithecus garhi

Australopithecus anamensis

Australopithecus afarensis

***Australopithecus* group**

Species in this group of early humans walked upright on a regular basis, but they still climbed trees, too.



Australopithecus anamensis

Name Means: Latin *australis* = "southern"; Turkana *anam* = "lake"

Nickname: none

When Found: 1965/1994

Who Found: B. Patterson/M. Leakey

Lived When: about 4.2-3.9 Ma

Lived Where: Lake Turkana, Kenya (Allia Bay, Kanapoi) & Middle Awash Valley, Ethiopia

How Big? ~ chimpanzee; strong sexual dimorphism

Fossil Record: ~100 fossils; ~20 individuals

Basic Morphology: human-like: **expanded upper tibia (shin bone)** and orientation of the ankle joint; ape-like: long forearms and wrist features

Known For: human-like knee

Burning Questions:

- Is *Au. anamensis* a separate species from *Au. afarensis*, or part of a single lineage?
- Is *Au. anamensis* a direct descendant of *Ar. ramidus*?



KNM-KP 271



KNM-KP 29285



Australopithecus afarensis

Name M

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on
veniles!

Basic Morphology: **mosaic** - ape-like: face proportions (a flat

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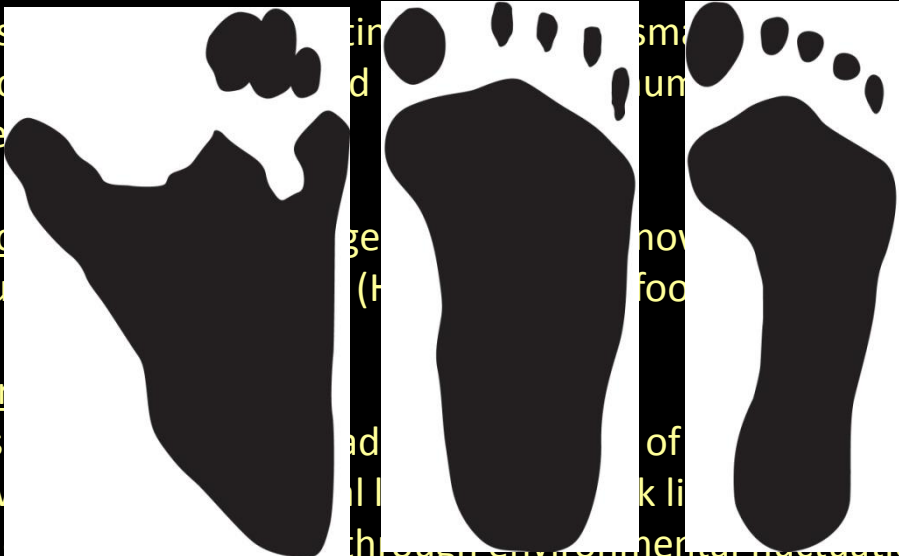
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- How do properties of *A. afarensis* teeth relate to their diet?



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Dikika child
Dik-1-1

Australopithecus africanus

Name Means: southern ape-man of Africa

Nickname: none

When Found: 1924

Who Found: R. Dart

Lived When: about 3.3-2.1 Ma

Lived Where: South Africa (Taung, Sterkfontein, Makapansgat, Gladysvale)

How Big? (avg) males: avg 4 ft 6 in, 90lbs; females: 3 ft 9 in, 66 lbs

Fossil Record: hundreds of fossils: skulls, partial skeletons

Basic Morphology: **mosaic** - ape-like: shoulder and hands, relatively long arms and a strongly sloping face that juts out from underneath the braincase with a pronounced jaw; human-like larger brain, smaller teeth, pelvis, femur (upper leg), and foot bones

Known For: 1st early human fossil found in Africa; 1st modern back curvature; osteodontokeratic culture

Burning Questions:

- Where did this species come from?
- Is it one of our ancestors? Or an ancestor of *Paranthropus*?
- What will “Little Foot” tell us about this species?



STS 14

Taung child



STS 5 “Mrs. Ples”

Australopithecus garhi

Name Means: southern ape-man of Africa

Nickname: none

When Found: 1990

Who Found: T. White, B. Asfaw & team

Lived When: about 2.5 Ma

Lived Where: Middle Awash, Ethiopia (Bouri)

How Big? ~other *Australopithecus*

Fossil Record: 1 skull + 4 other skull fragments, possibly a nearby partial skeleton

Basic Morphology: skull has a **mix** of *Homo*-like cranial features, an *Australopithecus*-like brain size, and large *Paranthropus*-sized teeth; partial skeleton has a longer femur (compared to other *Australopithecus* specimens, like 'Lucy') with long, powerful arms

Known For: ????

Burning Questions:

- Will scientists find more individuals of this species?
- Do the large molars of this species align it with *Paranthropus*? Or is it a late *Australopithecus*?
- Did it make the nearby stone tools and cutmarked animal bones?



Australopithecus sediba

Name Means: *sediba* = “natural spring/well” (SeSotho)

Nickname: none

When Found: 2008

Who Found: L. Berger (Matthew)

Lived When: between 1.95 and 1.78 Ma

Lived Where: South Africa (Malapa)

How Big? 4 ft 3 in tall; low sexual dimorphism

Fossil Record: MH1 (13-14 year old male), MH2 (adult female)

Basic Morphology: human-like: pelvis, femur and humerus strength, small premolars and molars, face, lower chest; ape-like: long arms, small brain size, upper chest

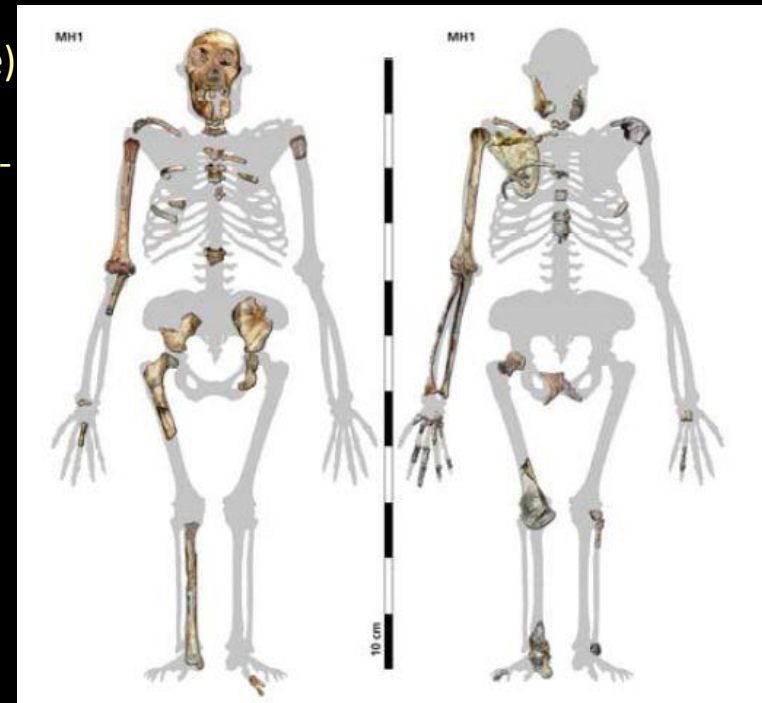
Known For: contender for ancestor of *Homo*;

remarkable completeness; unique form of bipedalism

Burning Questions:

- What is the time and geographic range this species?
- Is this species descended from *Au. africanus*?
- Is this species as closely related to *Homo* as some think?

MH1



Today

1

Million
years ago

2

Million
years ago

3

Million
years ago

4

Million
years ago

5

Million
years ago

6

Million
years ago

Past

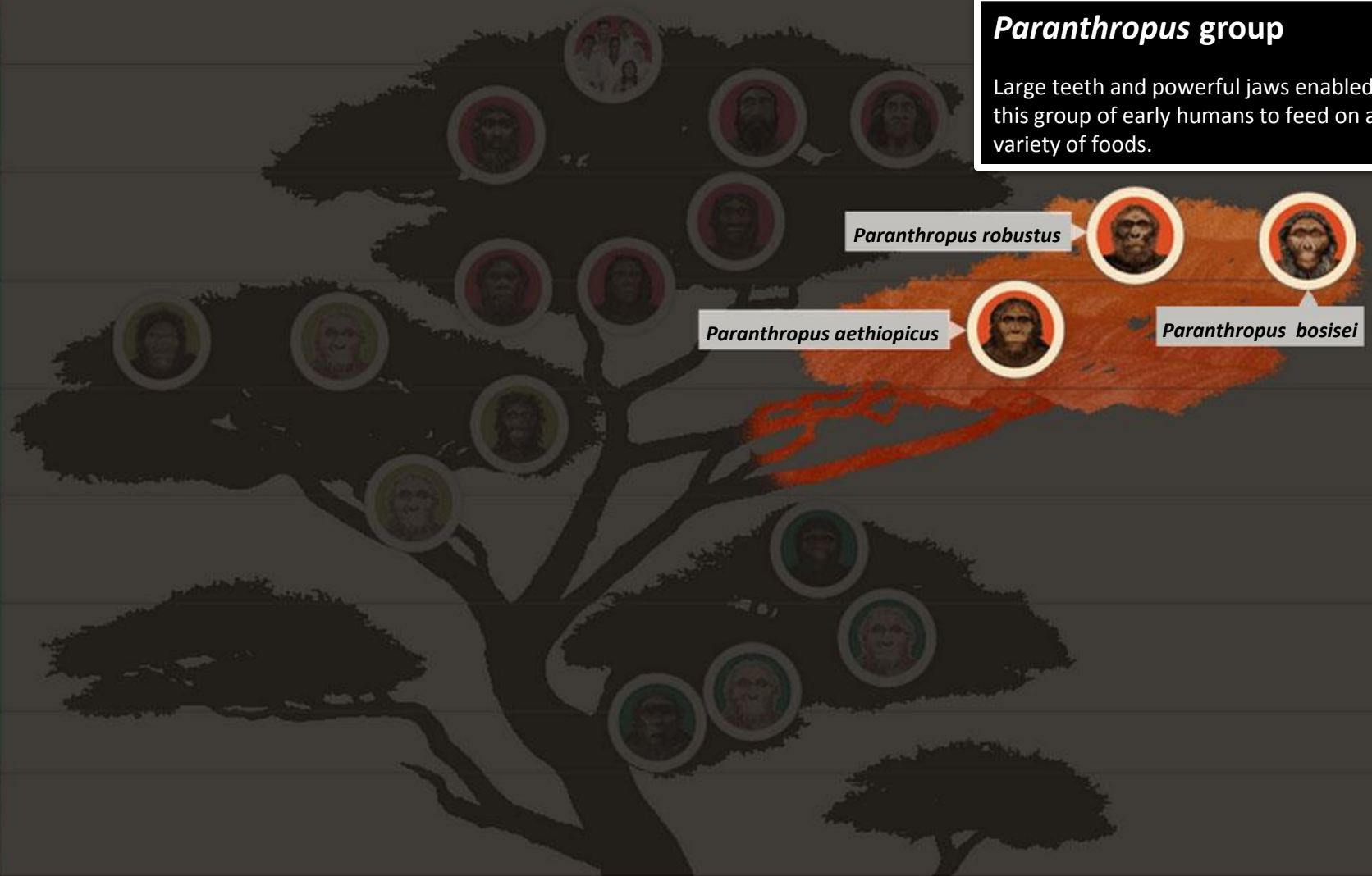
Paranthropus group

Large teeth and powerful jaws enabled this group of early humans to feed on a variety of foods.

Paranthropus robustus

Paranthropus aethiopicus

Paranthropus boisei



Paranthropus aethiopicus

Name Means: “*Para*” = beside (Greek); “*anthropus*” = man; “*aethiopicus*” = from southern Africa

Nickname: “The Black Skull”

When Found: 1967 / 1985

Who Found: French team (Omo 18) / Alan Walker & Richard Leakey (KNM-WT 17000)

Lived When: about 2.7 – 2.3 Ma

Lived Where: eastern Africa (northern Kenya, southern Ethiopia)

How Big? Unknown; may be large

Fossil Record: one fairly complete skull, a few other bits

Basic Morphology: strongly protruding face, huge teeth, powerful jaw, and a well-developed **sagittal crest** on top of skull

Known For: big sagittal crest, teeth, and jaws

Burning Questions:

- What kind of environments did it prefer to live in?
- Is it actually more closely related to *Au. afarensis*, or the other “robust” australopithecines like *P. boisei*, which may be its direct descendant?
- How big were this species (body size)?
- Did it exhibit body size sexual dimorphism, like most other australopiths?



KNM-WT 17000

Paranthropus boisei

Name Means: *Zinj* for the medieval East African region of Zanj; *boisei* for Charles Boise, the team's funder

Nickname: "Zinjanthropus", "Nutcracker Man"

When Found: 1955 / 1959

Who Found: Mary Leakey

Lived When: about 2.3 – 1.2 Ma

Lived Where: eastern Africa (Ethiopia, Kenya, Tanzania, Malawi)

How Big? (avg) males: 5 ft 4 in, 108 lbs; females: 4 ft 1 in, 75 lbs

Fossil Record: some nearly complete skulls, some postcrania

Basic Morphology: big sagittal crest; **huge cheek teeth with very thick enamel; flaring cheekbones**

Known For: big teeth, sagittal crests, strong chewing muscles, co-existed with *H. habilis*, *H. erectus* and *H. rudolfensis* in east Africa

Burning Questions:

- What did *P. boisei* eat? (tooth morphology and microwear conflict)
- Did *P. boisei* use stone tools? (found in stratigraphic layers w/ lithics)
- What was the advantage of the big jaws and teeth of *P. boisei*?
- Did their highly specialized diet lead to their extinction?



KNM-ER 406



KNM-ER 732



Paranthropus robustus

Name Means: *robustus* = robust

Nickname: none

When Found: 1938

Who Found: Robert Broom

Lived When: about 1.8 – 1.2 Ma

Lived Where: southern Africa (South Africa) - Swartkrans, Kromdraai, Drimolen, Gondolin, Coopers

How Big? (avg) males: 3 ft 9 in, 119 lbs; females: 3 ft 3 in, 88 lbs

Fossil Record: >130 individuals just at Swartkrans

Basic Morphology: **big teeth with thick enamel**, flaring cheekbones, sagittal crest

Known For: Using bone tools to dig in termite mounds

Burning Questions:

- Which species did *P. robustus* evolve from? Was it *P. aethiopicus*, or were there regionally distinct robust australopithecine lineages - meaning it evolved from *Au. africanus*?
- Bone tools presumably used by *P. robustus* to dig into termite mounds have been found at several South African sites. Was this behavior something shared by all populations, or was it regional?



SK 48



DNH 7



Today

1

Million years ago

2

Million years ago

3

Million years ago

4

Million years ago

5

Million years ago

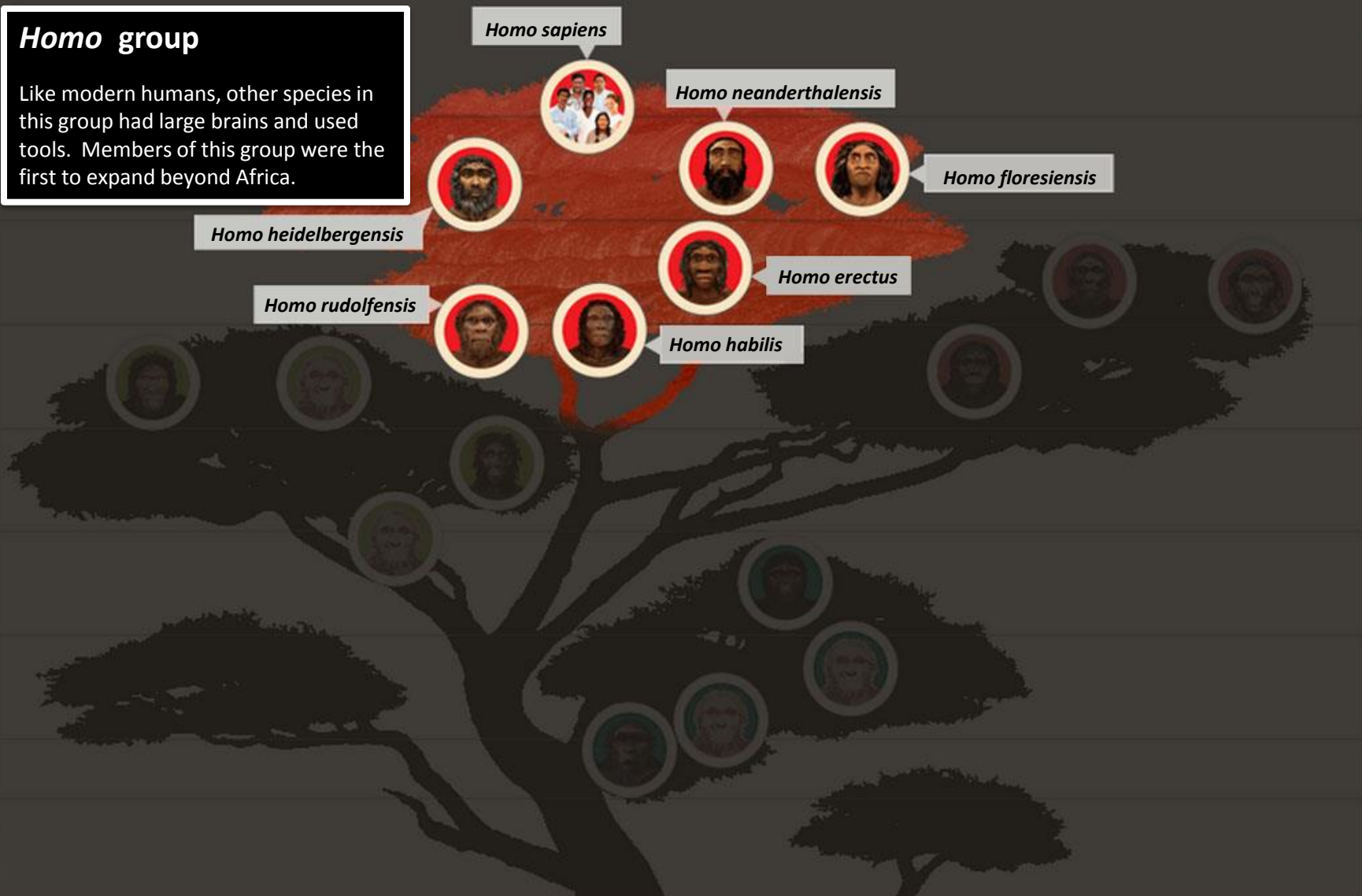
6

Million years ago

Past

Homo group

Like modern humans, other species in this group had large brains and used tools. Members of this group were the first to expand beyond Africa.



Homo habilis

Name Means: handy man

Nickname: none

When Found: 1960

Who Found: Louis & Mary Leakey

Lived When: about 2.4-1.4 Ma

Lived Where: eastern and southern Africa

How Big? 3 ft 4 in – 4 ft 5 in; 70 lbs

Fossil Record: many fairly complete skulls, partial skeleton, others

Basic Morphology: slightly **larger braincase and smaller face and teeth** than *Australopithecus*; modern arch of the foot; some ape-like features (long arms and a moderately prognathic face)

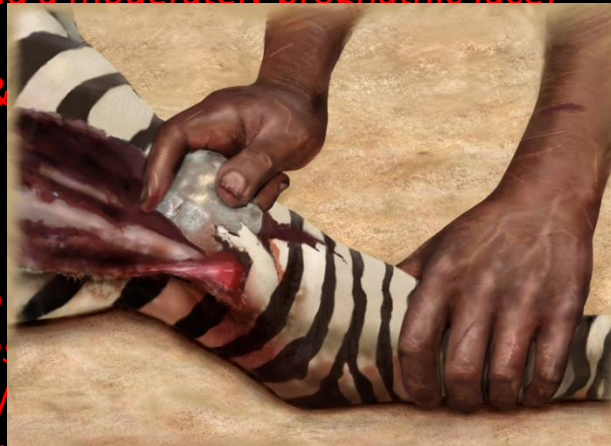
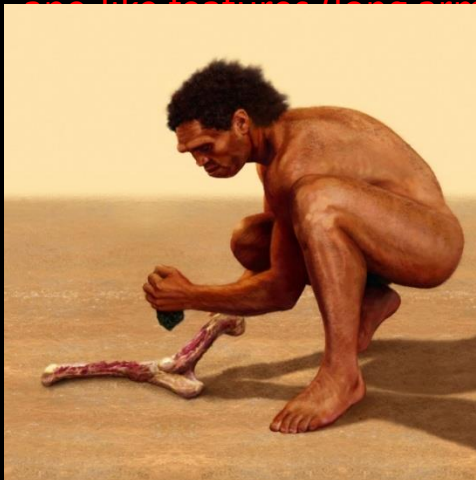


OH 24



KNM-ER
1813

OH 8



Homo rudolfensis

Name Means: (named after specimen found in Lake Rudolf, Kenya)

Nickname: none

When Found: 1972 (named in 1986)

Who Found: Richard Leakey

Lived When: about 1.9-1.8 Ma

Lived Where: eastern Africa (northern Kenya, possibly northern Tanzania and Malawi)

How Big? Unknown (no body fossils)

Fossil Record: only one really good skull; also 2 jaws w/teeth and a face

Basic Morphology: **larger braincase, longer face,** and larger premolar and molar teeth than *Homo habilis*

Known For: one of earliest *Homo* species

Burning Questions:

- Was *Homo rudolfensis* part of our direct evolutionary lineage?
- Are *Homo rudolfensis* and *Homo habilis* indeed different species? Or was one ancestral to the other?
- Are *Homo rudolfensis* fossils more like australopithecines than other *Homo* fossils, as some scientists have suggested?
- How big was *Homo rudolfensis*? Was this species sexually dimorphic?



KNM-ER 1470

Homo erectus

Name Means: upright walking man

Nickname: “Turkana Boy”, ‘Peking Man”, “Java Man”

When Found: 1891

Who Found: E. Dubois “*Pithecanthropus erectus*” (Trinil 2)

Lived When: about 1.89 Ma – 70,000 Ya

Lived Where: Northern, Eastern, and Southern Africa; Western Asia (Dmanisi, Republic of Georgia); East Asia (China and Indonesia)

How Big? 4 ft 9 in – 6 ft 1 in; 88-150 lbs

Fossil Record: many fairly complete skulls, partial skeletons

Basic Morphology: **human-like body size and shape** with longer legs and shorter arms

Known For: longest lived species on our family tree; first out of Africa; modern body size and shape; Acheulean handaxes; increased meat-eating; first evidence of caring for old, weak individuals

Burning Questions:

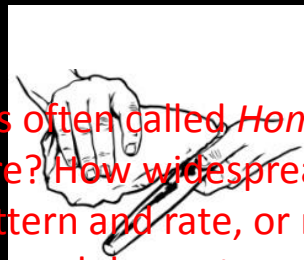
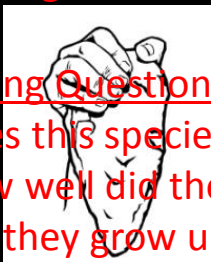
- Does this species encompass African fossils often called *Homo ergaster*?
- How well did they master the control of fire? How widespread was it?
- Did they grow up in a more ape-like pattern and rate, or more ape-like one? Was it the first species to experience an adolescent growth spurt?



Choukoudien



Dmanisi D3444



Turkana Boy

Homo heidelbergensis

Name Means: (named after the University of Heidelberg, Germany)

Nickname: none

When Found: 1908

Who Found: workman Daniel Hartmann -> Professor Otto Schoetensack

Lived When: about 700,000 – 200,000 Ya

Lived Where: Europe; Africa (eastern and southern); possibly Asia (China)

How Big? (avg) males: 5 ft 9 in, 136 lbs; females: 5 ft 2 in, 112 lbs

Fossil Record: many fairly complete skulls, partial skeletons

Basic Morphology: **very large brow ridge + braincase**, flat face; short, wide bodies

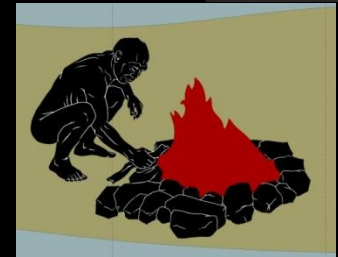
Known For: Living in colder climates; first to control fire; first to build shelters; first to routinely hunt large animals with wooden (thrusting) spears; direct ancestor of modern humans & Neanderthals

Burning Questions:

- Is there more than one species represented among *H. heidelbergensis* fossils (*H. antecessor*, *H. cepranensis*, and *H. rhodesiensis*)?
- Did regional groups or populations of *H. heidelbergensis* exhibit any unique behaviors or anatomical adaptations?
- Did this species have cultural or behavioral adaptations to the cold?



Petralona



"Denisovans"

Name Means: (named after the cave where it was discovered)

Nickname: none

When Found: 2008

Who Found: Russian archaeologists

Lived When: ~41,000 Ya (to 400,000 ya?)

Lived Where: Siberia (to southeast Asia) - and Spain?

How Big? (avg) males: 5 ft 9 in, 136 lbs; females: 5 ft 2 in, 112 lbs

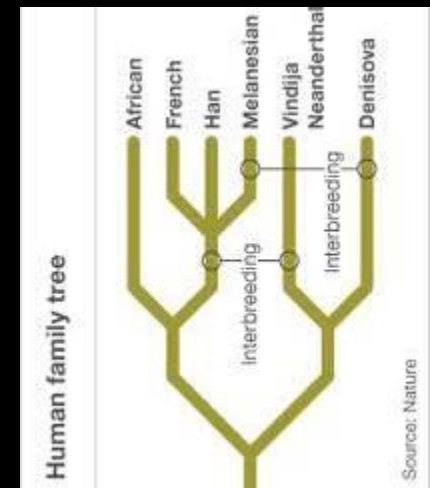
Fossil Record: finger bone, 2 teeth , toe bone, (?)

Basic Morphology: **Neanderthal-like but more primitive**

Known For: interbred with Neanderthals (17% of Denisovan DNA is Neanderthal) and modern humans (Melanesians, some SE Asians, and Australian Aboriginals: 4-6%)

Burning Questions:

- Denisovans shared a common ancestor with modern humans (804myr) and Neanderthals (640myr) 1Ma. Who was that ancestor?
- DNA analysis indicates they were part of a separate out-of-Africa migration. When did this occur?
- Did this species have "culture"? (A bracelet was found in the same layers as the hand and foot bones)



Homo neanderthalensis

Name Means: “tal” – a modern form of “thal” = valley
(Feldhofer Cave, Neander Valley, Germany)

Nickname: “Neanderthal Man”

When Found: 1829 , 1848, named in 1864

Who Found: quarry workers -> local teacher Fuhlrott -> anatomist Schaaffhausen

Lived When: about 200,000 – 28,000 Ya

Lived Where: Europe; southwestern to central Asia

How Big? (avg) males: 5 ft 5 in, 143 lbs; females: 5 ft 1 in, 119 lbs

Fossil Record: many nearly complete skulls and skeletons

Basic Morphology: low forehead; brow ridges; large middle face; angled cheek bones; big nose; big brains; short, muscular bodies; DNA tells us some had red hair & fair skin

Known For: Our closest extinct cousins; made sophisticated tools (Mousterian); skilled large game hunters (including marine shellfish & mammals); made loose-fitting clothing; occasionally made symbolic/ornamental objects; burial (ritual?)

Burning Questions:

- Will the Neanderthal genome project identify what’s unique about them, and us?
- Why did they go extinct? Climate change? Competition with modern humans?
- What was the relative contribution of animal and plant sources to their diet?
- Were Neanderthals routinely symbolic, or did this just occur in specific populations?



composite skeleton



La Chapelle-aux-Sants



La Ferrassie

Shanidar 1



Homo floresiensis

Name Means: (named after the island of Flores, where it was found)

Nickname: “Hobbit”

When Found: 2003

Who Found: Indonesian-Australian team

Lived When: about 95,000 – 17,000 Ya

Lived Where: Asia (Indonesia)

How Big? 3 ft, 6 in; 66 lbs

Fossil Record: LB 1 (nearly complete female skeleton), 12+ others

Basic Morphology: tiny brains, large teeth, no chins, receding foreheads, shrugged-forward shoulders, relatively large feet (due to short legs)

Known For: very small body and brain size, most recent species to go extinct, most recent species to be discovered*

Burning Questions:

- How did these early humans manage to get to the island of Flores?
- Which hominin species made the 1 million year old stone tools found on Flores? Was this species the ancestor of *H. floresiensis*?
- Did *H. floresiensis* have cultural expression (language , art)?
- Did *H. floresiensis* ever come into contact with *H. sapiens*?
- Was a volcanic eruption on Flores the reason this species went extinct?



LB 1



LB 1



Homo sapiens

Name Means: Latin: “wise man” or “knowing man”

Nickname: “Cro-Magnon Man”

When Found: 1868 / no true type specimen

Who Found: (workmen)

Lived When: about 200,000 Ya - present

Lived Where: evolved in Africa, now worldwide

How Big? varies across time and space

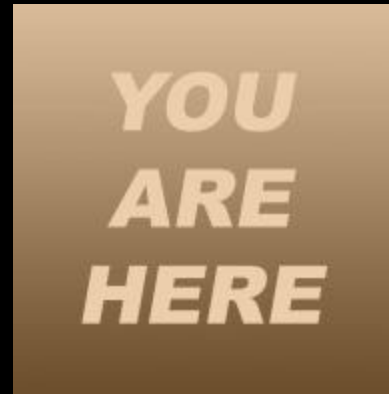
Fossil Record: excellent!

Basic Morphology: lighter skeletons than earlier humans; thin-walled, high-vaulted skull with flat and near vertical forehead; virtually no brow ridges; lightly built jaws with smaller teeth

Known For: Worldwide distribution with huge population size, very large brains, using tools to make other tools/technological advancements, agriculture and domestication, civilization/cities, low genetic diversity

Unique Behaviors:

fishing; bows and arrows; long distance trade and social networks; varied diet; language, writing, art, music, personal adornment, rituals; abstract reasoning; self-awareness; long growth & development (only species to have grandparents), ...



Cro-Magnon 1



Skhul V



Australopithecus africanus

(female)

Lived 3.3 -2.1 million years ago
Southern Africa

Homo erectus

(female)

Lived 1.89 million – 70,000 years ago
Africa; Asia; possibly Europe

Homo neanderthalensis

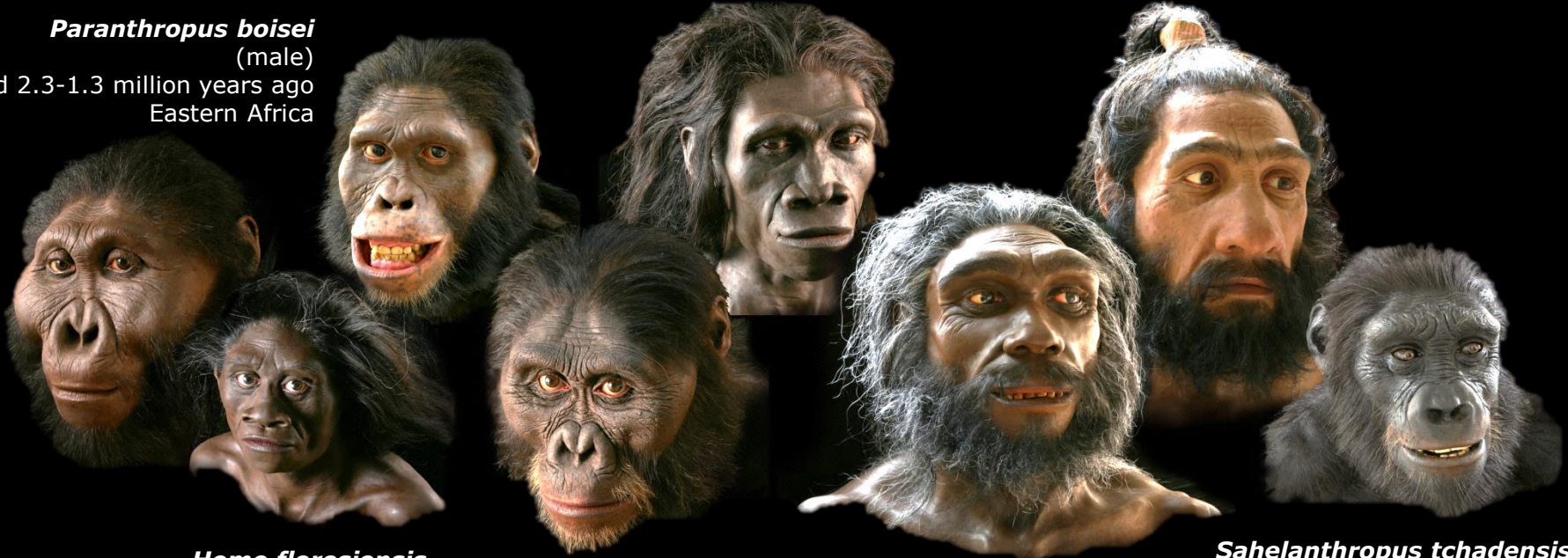
(male)

Lived 200,000 – 28,000 years ago
Europe and Asia

Paranthropus boisei

(male)

Lived 2.3-1.3 million years ago
Eastern Africa



Homo floresiensis

(female)

Lived 95,000 -17,000 years ago
Southeast Asia; nicknamed 'Hobbit'

Australopithecus afarensis

(male)

Lived 3.85 – 2.95 million years ago
Eastern Africa

Homo heidelbergensis

(male)

Lived 700,000 -200,000 years ago
Europe, Asia, Africa

Sahelanthropus tchadensis

Lived 7-6 million years ago
Africa

Homo erectus



Paranthropus boisei



Homo floresiensis



Homo heidelbergensis



Homo neanderthalensis





