

# **Chordate, Vertebrate, and Hominin Diversification**

**Today's questions:**

- I. What synapomorphies define the chordates?**
- II. What synapomorphies define major vertebrate lineages?**
- III. What trends occurred in hominin evolution?**

**(cell phones off, please)**

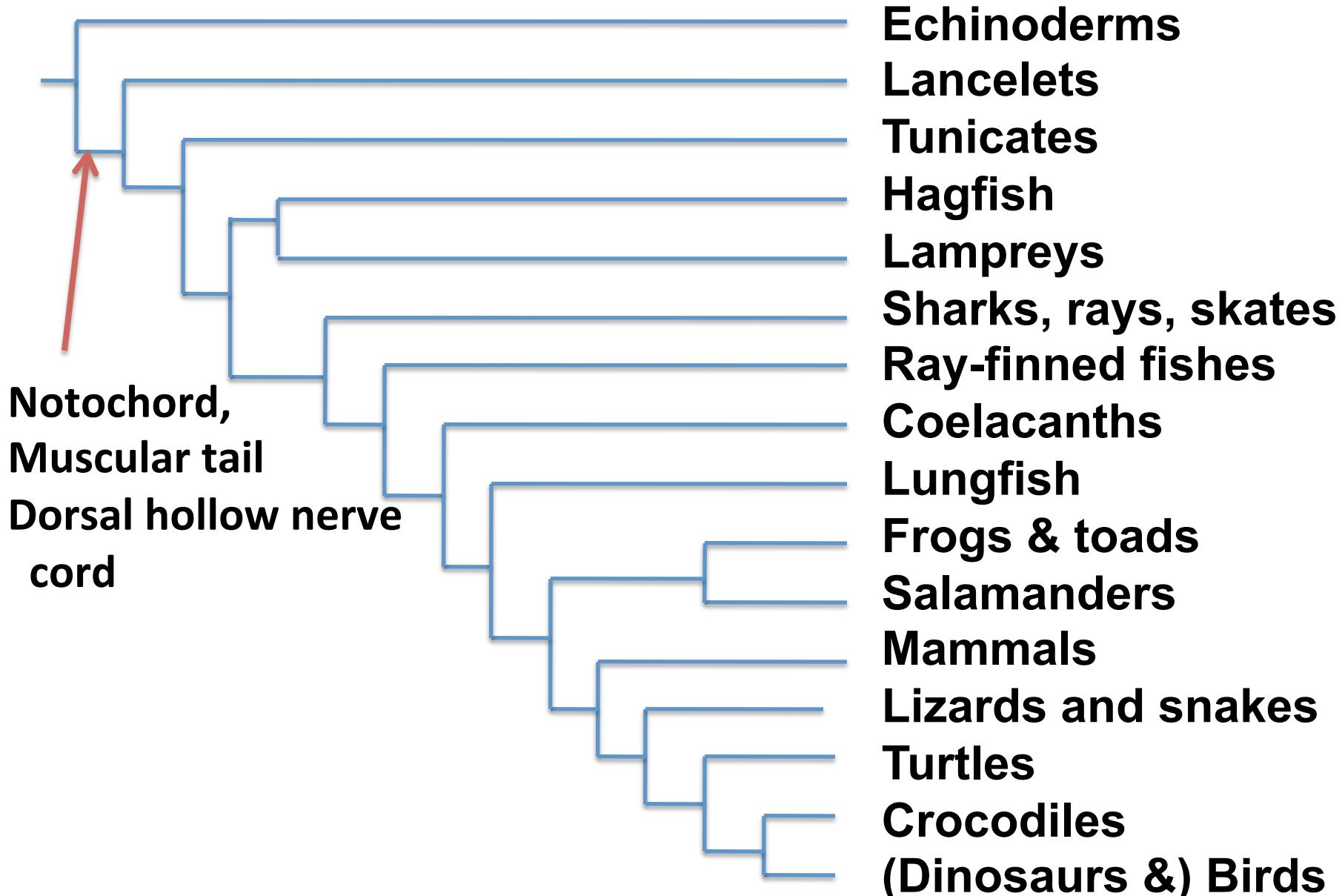
**Q1. Shingles is caused by a Herpes virus that infects human nerve cells. The blisters that form during a flare-up are usually found in one or more horizontal lines across the back or chest, corresponding to the nerve and skin derived from a particular somite (somites are repeated structures that form along the notochord, early in development). This is evidence of:**

- 1. Deuterostome development**
- 2. Bilateral symmetry**
- 3. Segmentation**
- 4. Presence of a coelom**

**Q2. Humans have thoracic and abdominal cavities (divided by the diaphragm) that are lined with an epithelium (“skin”) derived from mesoderm. This is evidence of:**

- 1. Deuterostome development**
- 2. Bilateral symmetry**
- 3. Segmentation**
- 4. Presence of a coelom**

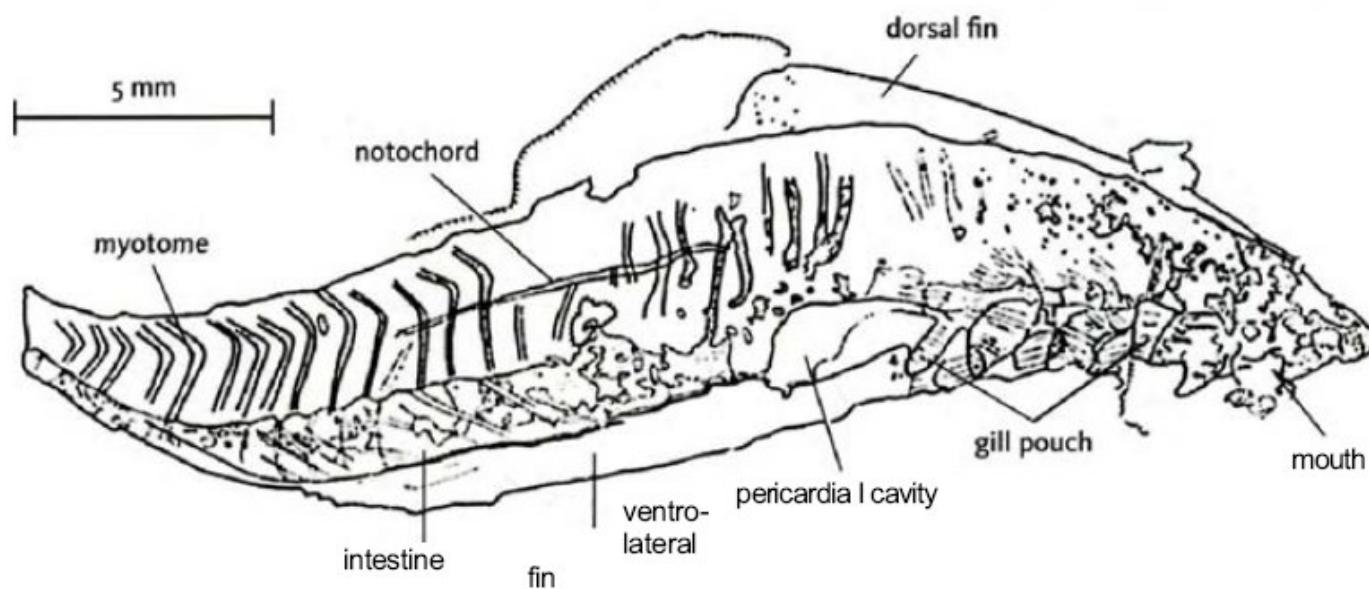
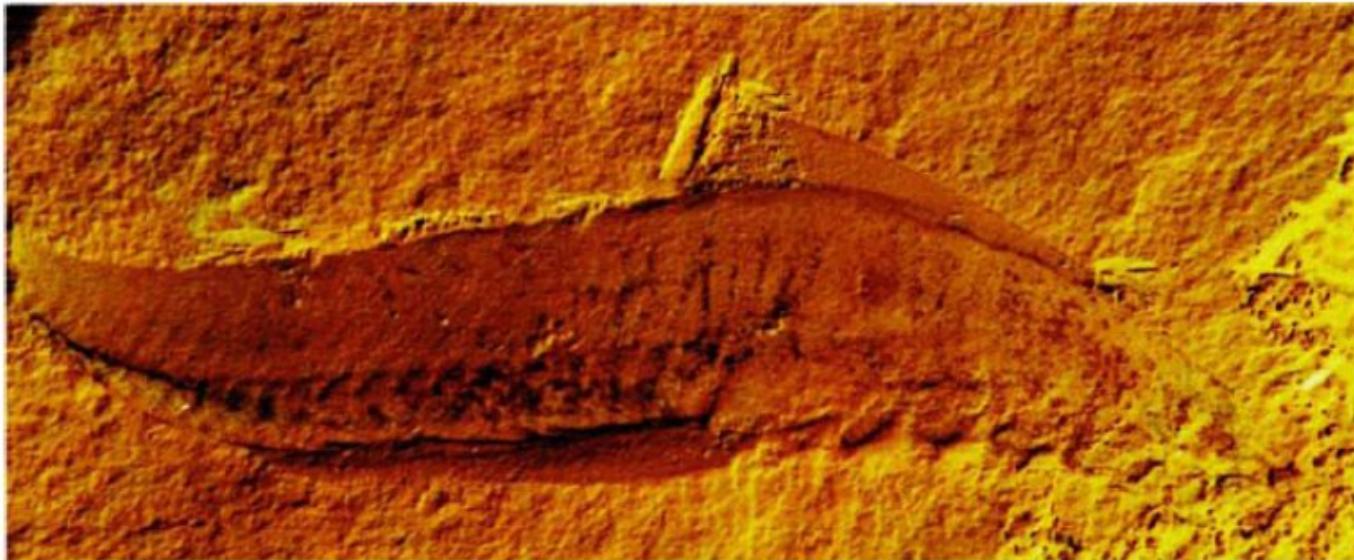
# I. What synapomorphies define the chordates?



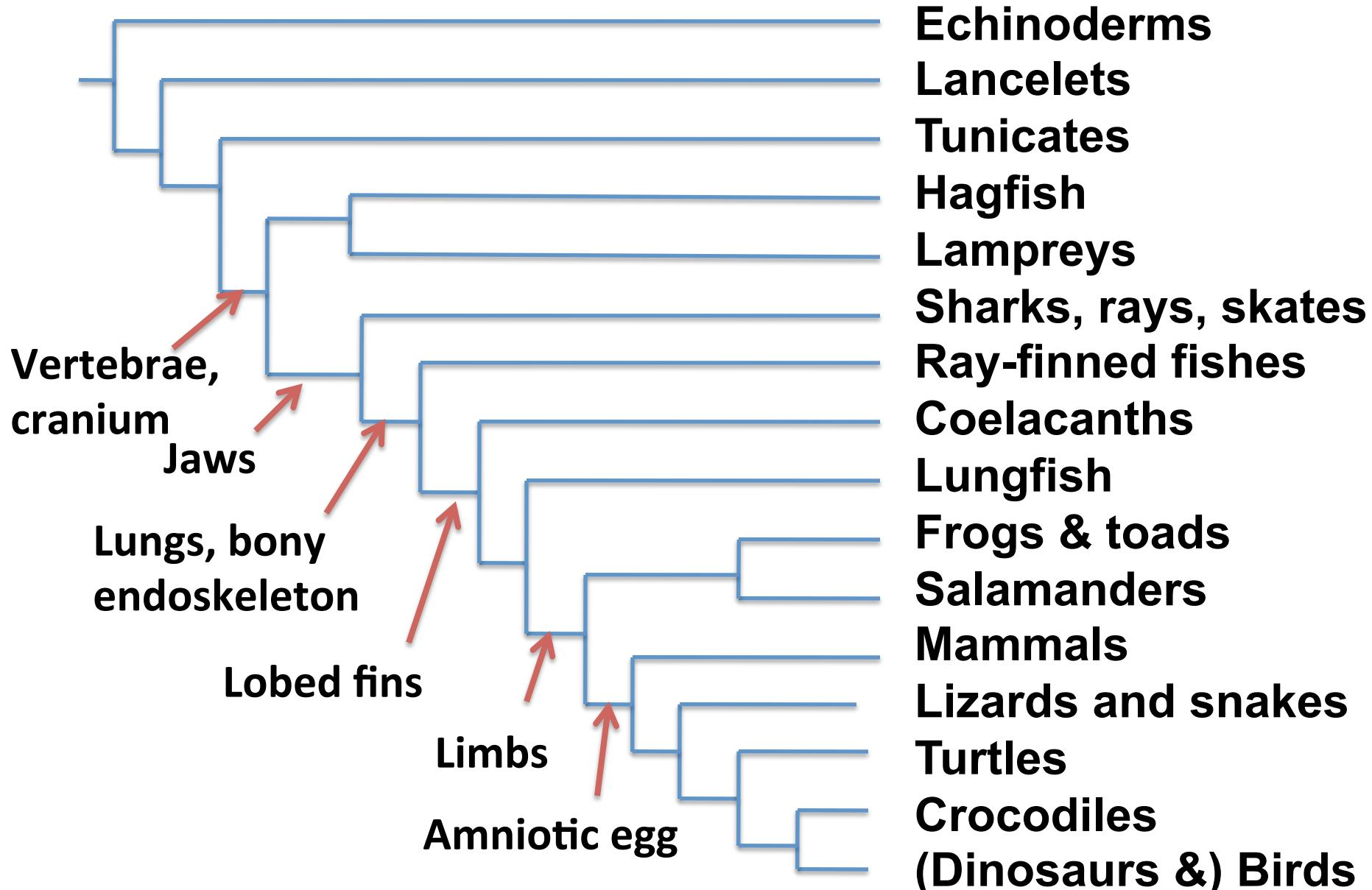
# **What is the adaptive significance of**

- the notochord?**
- a muscular tail that extends past the anus?**
- a CNS with a dorsal hollow nerve cord?**

# First craniate/vertebrate? *Haikouichthys*



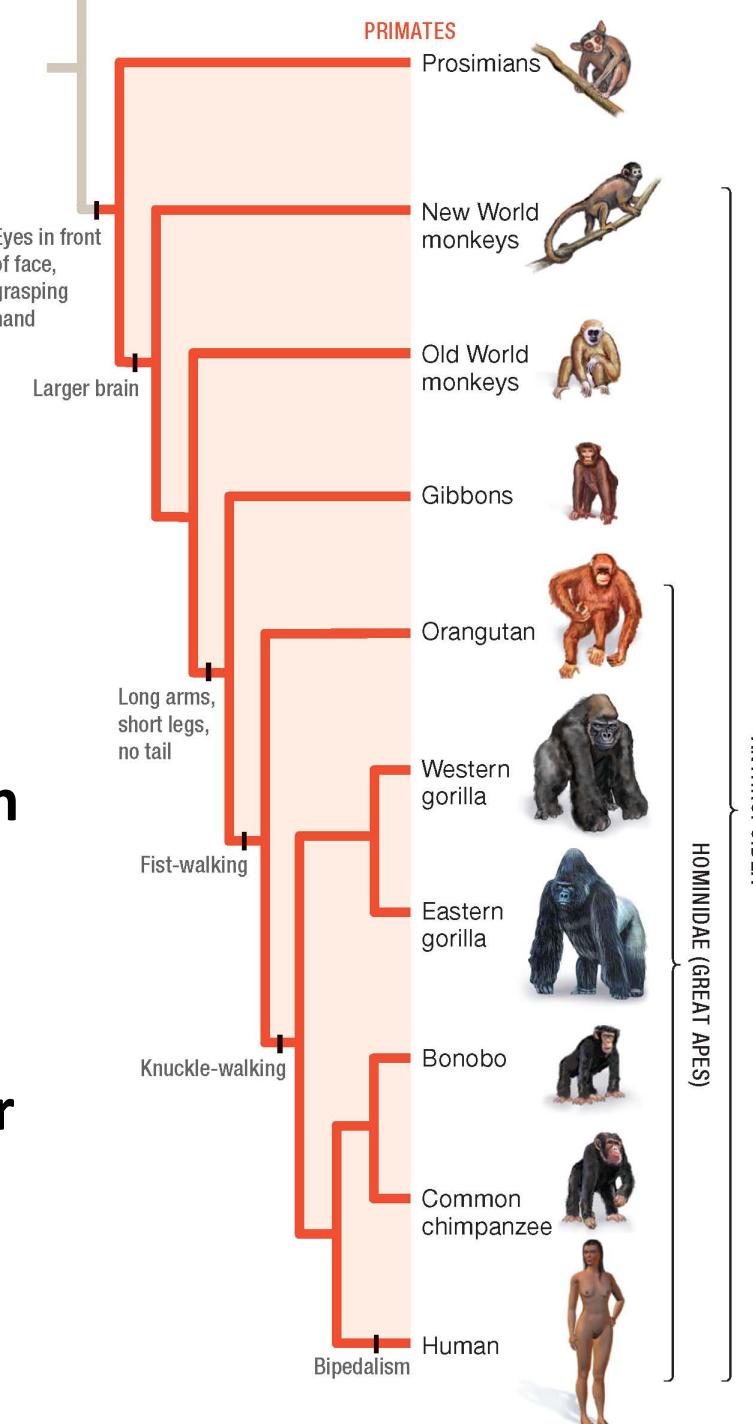
## II. What synapomorphies define major vertebrate lineages?



### III. What trends occurred during hominin evolution?

**Q3. Gibbons (“lesser apes”), orangs, gorillas, and chimps are all forest-dwelling. What is the ecological significance of “fist-walking” as a synapomorphy?**

1. The great apes spend more time on the ground than gibbons.
2. It is more efficient than knuckle-walking.
3. Gibbons are an outgroup and sister group to great apes.
4. Both gibbons and great apes are tailless.



- Western gorillas, eastern gorillas, chimps, and bonobos knuckle-walk, live in African forests, and live in social groups.
- Chimps and bonobos make and use tools; chimps (and bonobos?) hunt. They also teach their offspring how to do things—meaning that they transmit culture.

Based on these data,  
describe the traits of  
the common ancestor  
of chimps and humans.

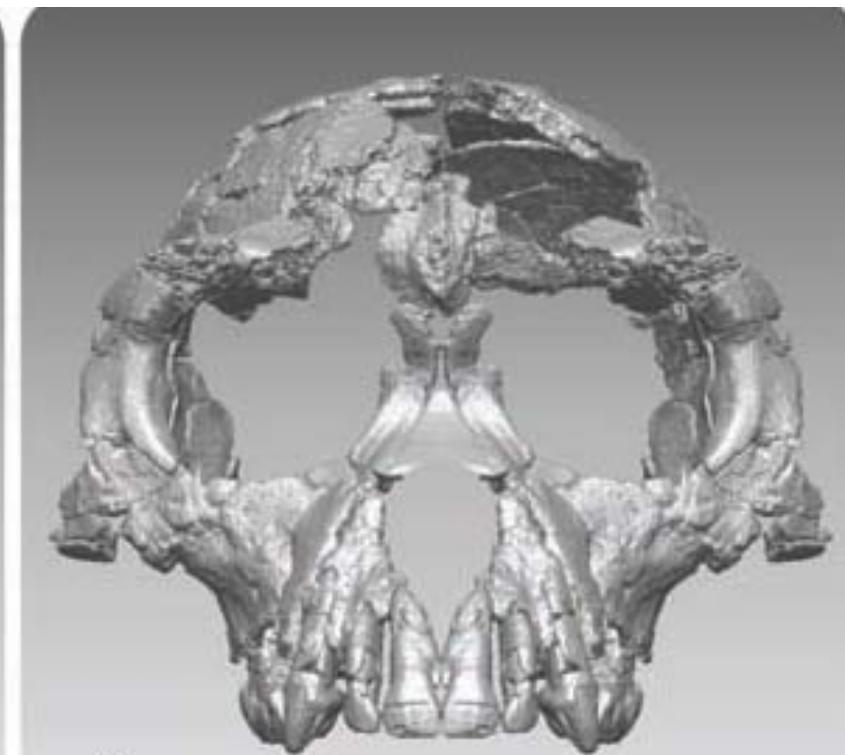
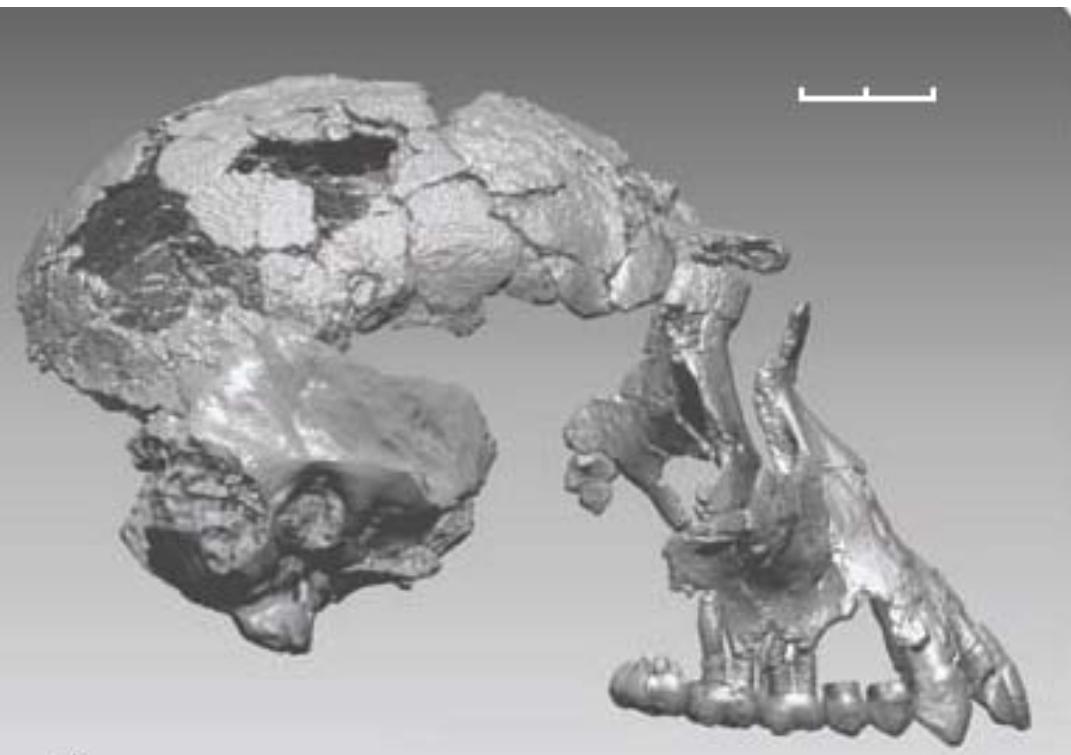
*Ardipithecus ramidus*

Braincase: 300-350cc

Females ~1.2m; males ~?m

Partly bipedal; partly knuckle-walking; tree-dwelling?

4.4 mya  
Ethiopia

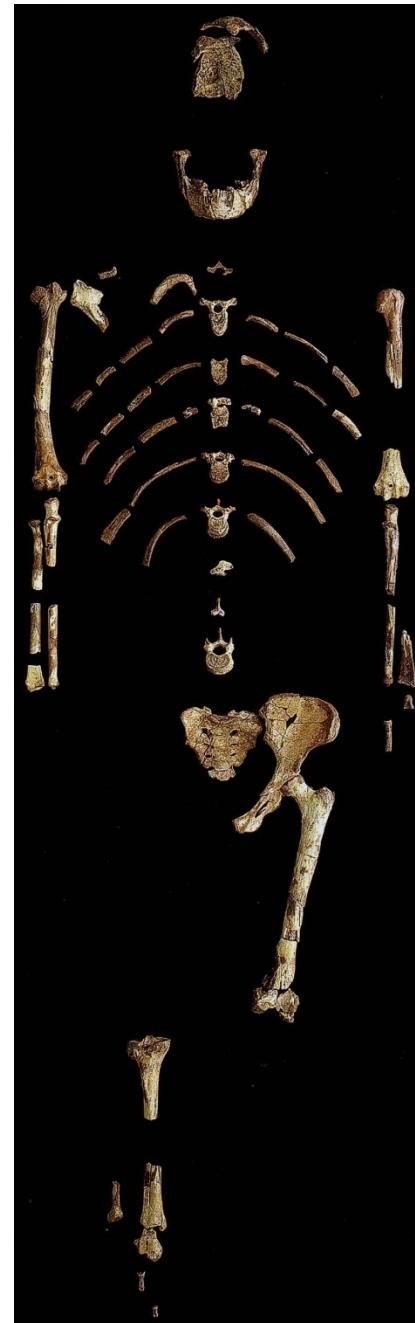


# *Australopithecus afarensis*

Braincase: 400-500cc

Females ~1.1m; males ~1.4-1.5m

Square jaw (ape-like)



3.9-3.0 mya  
Africa



*Australopithecus africanus*

Braincase: 400-500cc

Females ~1.1m; males ~1.4-1.5m

Round jaw (Hsapiens-like); large teeth and jaws

2.8-2.4 mya

South Africa



**Q4. In *Australopithecus*, about how much larger are males than females, in terms of average height?**

- 1. Same (0%)**
- 2. ~5-10%**
- 3. ~15-20%**
- 4. ~25-33%**

*Paranthropus boisei*

Braincase: 530cc

Females ~1.3m; males ~1.6m

Molars 4x Hsapiens; sagittal crest

2.3-1.4 mya

Kenya



*Paranthropus robustus*

Braincase: 530cc

Females ~1.1m; males ~1.5m

Large zygomatic arch

2.0-1.0 mya

South Africa



**Q5. What is the probable function of the large molars, zygomatic arches, and/or sagittal crests found in *Paranthropus*?**

- 1. Sexual display**
- 2. Processing coarse foods**
- 3. Biting prey**
- 4. Biting each other (e.g. in combat).**

*Homo (Australopithecus?) habilis*

1.9-1.6 mya

Braincase: 650cc

Kenya

Females ~1.2m; males ~1.3m

Stone tools; animal bones with marks indicating butchery



## *Homo erectus*

1.7-0.3 mya

Braincase: 900cc\* Africa, Caucasus, Asia (“Peking Man;” “Java Man”)

Females ?m; males ~1.7m

Extensive stone tools; fire?

\*early specimens; 1100cc late



**Q6. When Dr. Freeman was an undergraduate, most anthropologists thought that *H. erectus* populations from throughout the world independently and simultaneously evolved into *H. sapiens*, giving rise to the different human races observed today via gene flow. Why is this unlikely?**

1. Independent, simultaneous, and highly convergent evolution like this is improbable.
2. All of the *H. sapiens* populations can interbreed—which shouldn't happen if they had descended from *H. erectus*.
3. At the genetic and phenotypic level, human races are not as distinct as predicted by this hypothesis.

*Homo floresiensis*

Braincase: 417cc

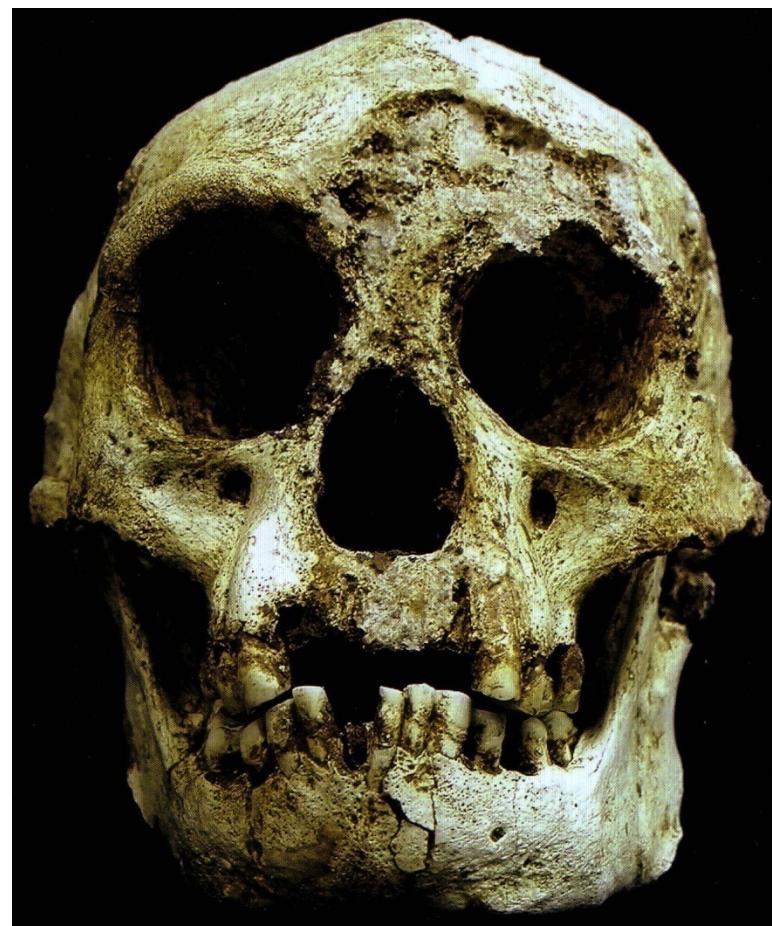
Females 1.06m; males ?m

Stone tools, fire; hunted dwarf elephants?

0.1-0.018 mya

Flores (Indonesia)

Nicknamed Hobbits



*Homo neanderthalensis*

Braincase: 1450cc

Females 1.56m; males ~1.68m

Prepared graves; speech?

0.3-0.03 mya

Europe, Middle East, Caucasus

*H. heidelbergensis* (Africa) a variant?



## *Homo sapiens*

0.1mya-present

**Braincase:** Cro-Magnon 1350cc (now 1200 cc)   Europe, Asia, Africa

**Currently:** Males about 10% taller than females, on average

**Grave with 2 other adult men, adult woman, infant, animal bones, jewelry, stone tools**



# **What trends occurred during human evolution?**

**1. Body size (height)**

**2. Male:female size**

**3. Posture**

**4. Tooth size**

**5. Facial features**

**6. Braincase volume**