

Human Evolution – Comparing Primates

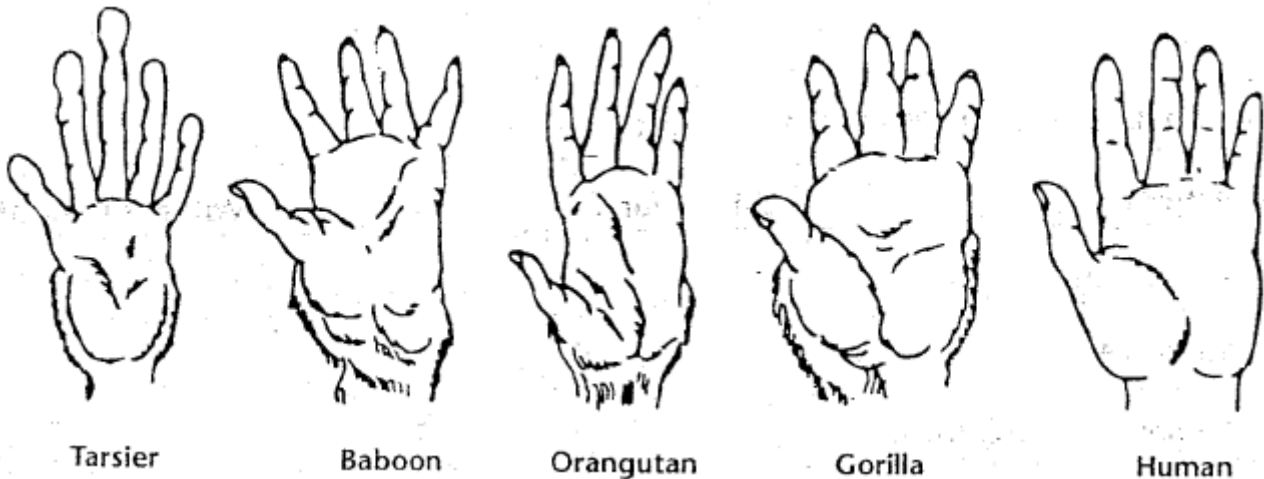
Background

According to the theory of evolution, all species are related and linked to a common ancestor. Species that are more closely related have common ancestor that existed much more recently, while species that are distantly related may have to go back hundreds of millions of years to find a common ancestor.

The closest living relatives to the *Homo sapiens*, the human species, are primates. This lab will compare many of the physical and biochemical characteristics between this group of animals.

Comparative Anatomy

Examine the drawings of the hands of five different primates shown below. Fill out the table of observations.

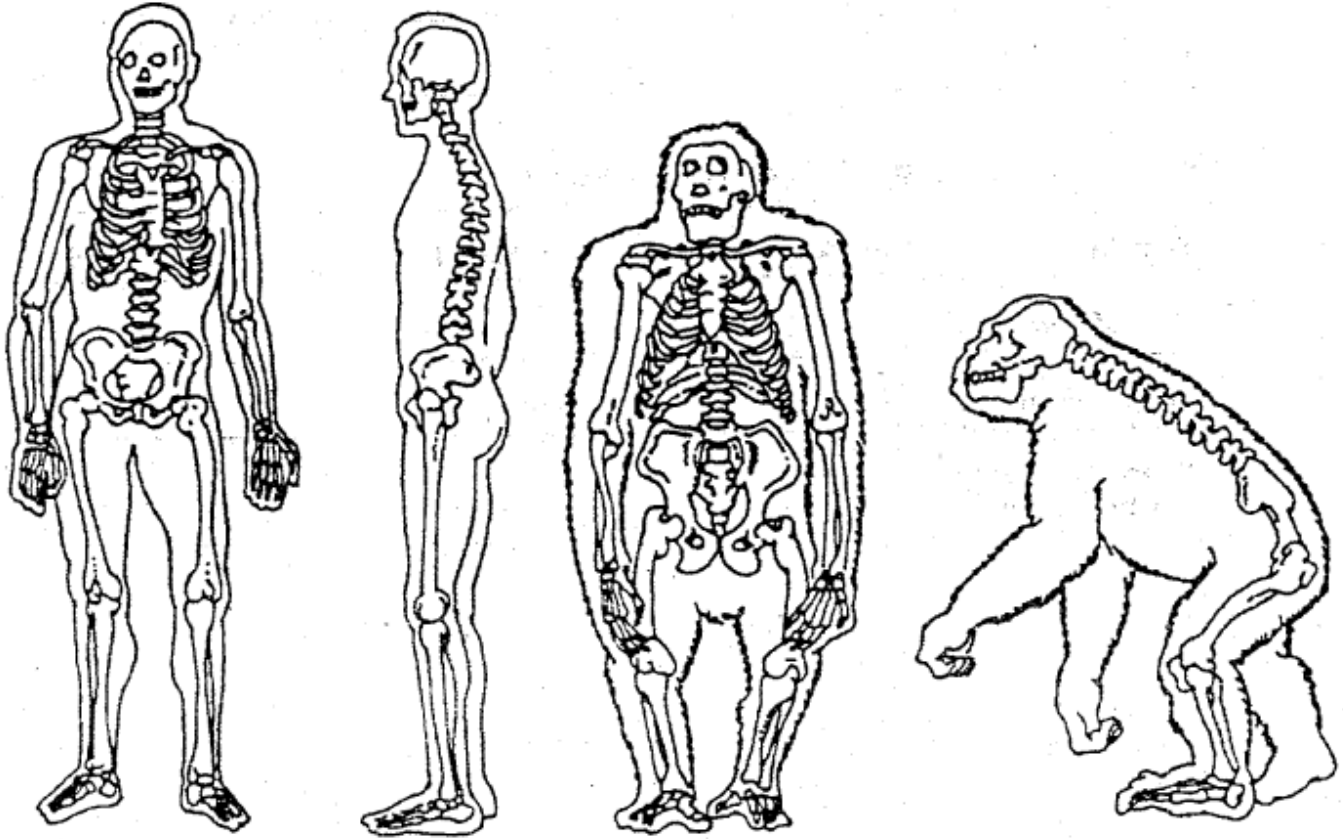


Source: Biology: The Dynamics of Life Textbook

Primate	Opposable Thumb?	Length of Thumb (cm)	Claws or Nails?

Name: _____ Class: _____ Date: _____

Compare the skeletons of the human and gorilla shown below.



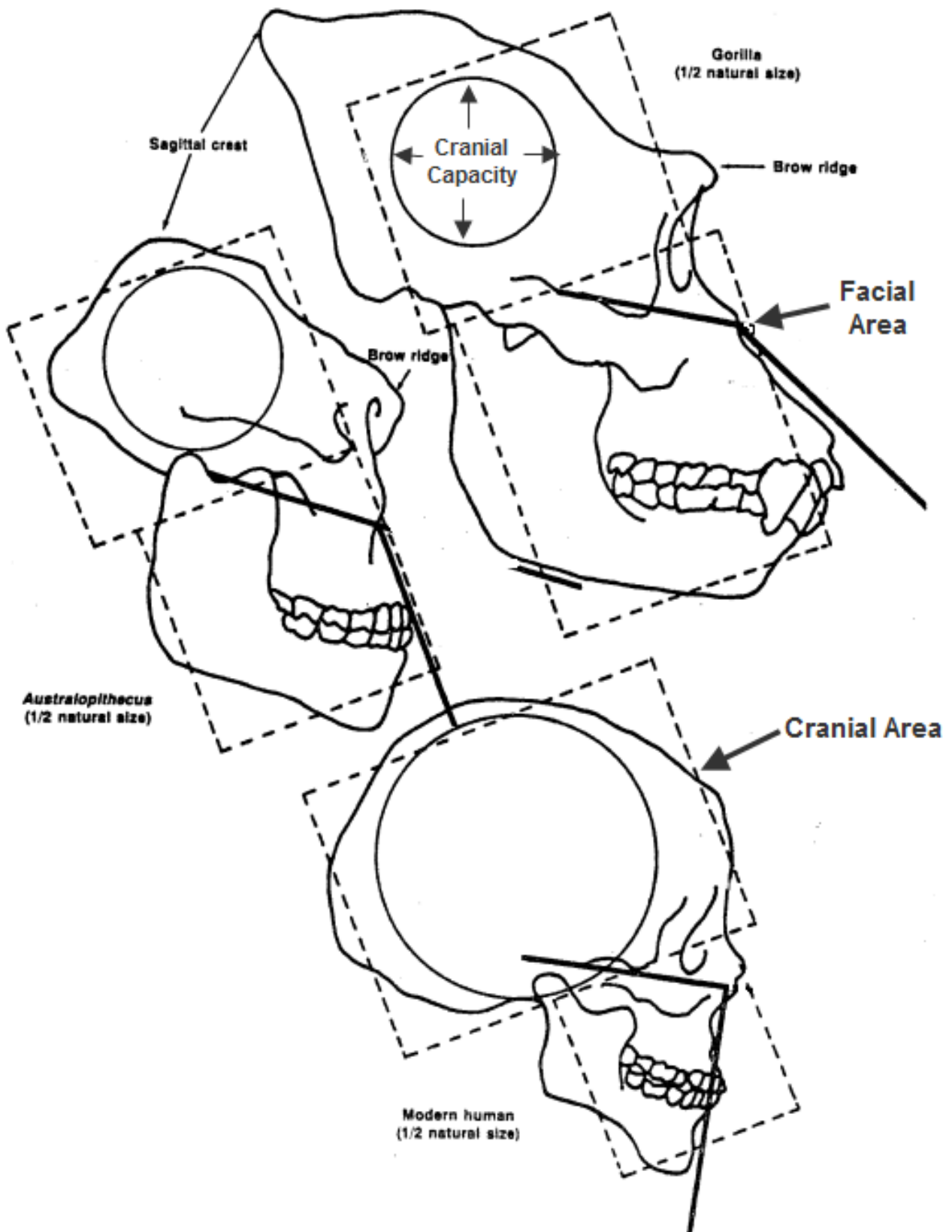
Source: Biology: The Web of Life Textbook

Characteristic	Human	Gorilla	Explain of Differences
Pelvis Shape			
Jaw Size			
Spine Shape			
Bone Arrangement of Feet			
Overall Height			
Arms Longer Than Legs			

2. What similarities do you see between the human and gorilla skeleton?

Name: _____ Class: _____ Date: _____

Scale drawings of skulls of the gorilla, modern humans, and a human ancestor called *Australopithecus africanus* are shown below. Examine each skull, paying special attention to the size of the brain cavity, the jaw size, and the jaw angle. Record all measurements on the table.



Name: _____ Class: _____ Date: _____

	Gorilla	Australopithecus	Modern Human
Facial Area (cm ²) (Length x width)			
Cranial Area (cm ²) (Length x width)			
Ratio of Cranial Area to Facial Area			
Cranial Capacity (cm ³) (2πr)			
Angle of Jaw			
Length of Incisors (cm)			
Presence of Brow Ridge			
Presence of Sagittal Crest			

3. Summarize the physical differences between the jaws of the gorilla, Australopithecus, and modern human. What does the jaw size suggest about how the diets of each species differ?

4. Summarize the physical differences between the craniums of the gorilla, Australopithecus, and modern human. What does this difference tell you about each species?

5. Given the comparisons you made between each skull, which species is most closely related to humans, the gorilla, or Australopithecus? Justify your answer with specific data.

Name: _____ Class: _____ Date: _____

Molecular Biology

Animals with red blood each have a large protein molecule called hemoglobin in their blood cells. Hemoglobin is needed to transport oxygen from the lungs to the rest of the body. Hemoglobin, like all proteins, is made of amino acids.

Below is a summary of some of the amino acids of hemoglobin. Partial sequences are given for humans, chimpanzees, gibbons, gorillas, a monkey, and a mouse. Sequences that are identical for all animals are skipped.

For each non-human animal, take a highlighter and mark any amino acids that are different than the human sequence. When you finish, record how many differences you found in the table on the next page.

	4	5	6	9	10	12	13	20	25	33	41	43	50	51	52
Human	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D
Chimpanzee	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D
Gibbon	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D
Gorilla	T	P	E	S	A	T	A	V	G	V	F	E	T	P	D
New World Monkey	T	P	E	N	A	T	T	V	G	L	F	E	S	P	D
Mouse	T	D	A	A	A	S	C	S	G	V	Y	D	S	A	S

	54	56	58	68	69	70	71	72	73	75	76	77	80	87	104
Human	V	G	P	L	G	A	F	S	D	L	A	H	N	T	R
Chimpanzee	V	G	P	L	G	A	F	S	D	L	A	H	N	T	R
Gibbon	V	G	P	L	G	A	F	S	D	L	A	H	N	Q	R
Gorilla	V	G	P	L	G	A	F	S	D	L	A	H	N	T	K
New World Monkey	V	G	P	L	G	A	F	S	D	L	N	H	N	Q	K
Mouse	I	G	A	I	T	A	F	N	D	L	N	H	S	S	R

	109	110	112	115	116	117	118	121	125	126	130	139
Human	V	L	C	A	H	H	F	E	P	V	Y	N
Chimpanzee	V	L	C	A	H	H	F	E	P	V	Y	N
Gibbon	V	L	C	A	H	H	F	E	Q	V	Y	N
Gorilla	V	L	C	A	H	H	F	E	P	V	Y	N
New World Monkey	V	L	C	A	H	H	F	E	Q	V	Y	N
Mouse	M	I	I	G	H	H	L	D	A	A	F	T

Animal	Number of Amino Acid Differences Compared to Human Hemoglobin
Chimpanzee	
Gibbon	
New World Monkey	
Mouse	

Molecular Biology – Summary Questions

6. Based on the hemoglobin data, which organism is most closely related to humans? Which is most distantly related to humans?

Conclusion

This is a cladogram for the major groups of primates. Based on the relationships shown in this cladogram, answer each of the following questions:

- Which primate species is most closely related to humans?
- Which primate species is most distantly related to humans?
- How long ago did speciation occur between tarsiers and the ancestor of all the anthropoids?
- According to this cladogram, about how long ago did the common ancestor between humans and chimpanzees exist?
- Explain why the statement “Humans evolved from monkeys” is incorrect.

