

Name _____ s. n. _____

Date _____ Per. _____

SKULL COMPARISONS: SUMMARY

DIRECTIONS:

1. For each Trait Difference, indicate briefly the condition in Modern Humans and Modern Apes (in general), in columns C and A/B.
2. For each Trait Difference, and for each species (D,E,F,G,H), indicate whether the trait is more ape-like (A), more human (H), or unique (U).
3. Add up all the A's, H's, and U's in each column, and place their respective totals in the spaces below each column.
4. Write a brief conclusion statement (what does all this comparison suggest?)

TRAIT DIFFERENCES	H	G	F	E	D	C	A/B
	A.afr	A.boi	H.ere	Neand	CroM	MOD HUMAN	MOD APE
1,2,3 CRANIUM SIZE							
5 FOREHEAD SHAPE							
6 FORAMEN MAGNUM POSITION							
8 BROWRIDGE SIZE							
9 FACIAL PROGNATH- ISM							
10 CHIN SHAPE							
11 DENTAL ARCADE SHAPE							
13 INCISORS ANGLE							
14 CANINE DIASTEMA							
15 UPPER CANINE LENGTH							

TOTALS: ___ ___ ___ ___ ___ "A"s (APE-LIKE)

TOTALS: ___ ___ ___ ___ ___ "H"s (HUMAN-LIKE)

TOTALS: ___ ___ ___ ___ ___ "U"s (UNIQUE)

CONCLUSION STATEMENT:

Name _____

SAMPLE OF POSSIBLE ANSWERS

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	A.afr	A.boi	H.ere	Neand	CroM	MOD HUMAN	MOD APE
1,2,3 CRANIUM SIZE	A	A	H	H	H	130-170 95	90-110 65
5 FOREHEAD SHAPE	A	A	A	A	H	vertical	slopes
6 FORAMEN MAGNUM POSITION	A	A	H	H	H	under	to rear
8 BROWRIDGE SIZE	A?	A	A	A	H	small	large
9 FACIAL PROGNATH- ISM	A	A	H	H	H?	20	60-130
10 CHIN SHAPE	A	A	A	A	H	sticks out	slopes back
11 DENTAL ARCADE SHAPE	H?	H?	H	H	H	parabolic	rectangular
13 INCISORS ANGLE	H	H	A	A?	H	vertical	slants forward
14 CANINE DIASTEMA	H	H	H	H	H	no	yes
15 UPPER CANINE LENGTH	H	H	H	H	H	10	18-40

TOTALS: 6 6 4 4 0 "A"s (APE-LIKE)

TOTALS: 4 4 6 6 10 "H"s (HUMAN-LIKE)

TOTALS: 0 0 0 0 0 "U"s (UNIQUE)

CONCLUSION STATEMENT: Features generally become less ape-like and more human-like, going left to right.

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SKULL ANALYSIS

A. Describe four features of a hominid's skull which suggest that it was bipedal

- 1.
- 2.
- 3.
- 4.

B. Describe two features of a hominid's post cranial skeleton (does not include skull) which suggest that it was bipedal:

- 1.
- 2.

C. What are two non-skeletal clues that early hominids were bipedal, and/or had continuous free use of hands

- 1.
- 2.

D. Why is it impossible for humans to have evolved from apes?

E. We observed that when fossil hominid skulls are arranged from oldest to most recent, they generally show small differences from skull to skull, trending toward the modern condition. What does this suggest about their biological relationship?

F. We also observed that when fossil hominid skulls are arranged from oldest to most recent, the oldest showed more ape-like features than later ones. What does this suggest about the biological relationship, if any, between apes and humans? (Keep in mind your answer to #D)

G. What is the evidence that two or more different species of hominids may have lived at the same time in the past?

H. What are the two the most recent changes in hominids, resulting in the final modern appearance of the human skull?

- 1.
- 2.

KEY to Skull Analysis

- A.
 - 1. short canines
 - 2. foramen magnum forward and under middle of skull
 - 3. neck muscle attachment mostly on underside of skull
 - 4. parabolic (curved) shape of dental arch, & reduced prognathism
- B.
 - 1. hip bones fan shaped
 - 2. femur angled in toward knee joint, and not curved much
- C.
 - 1. stone tools chipped in systematic pattern
 - 2. footprints showing bipedal walking (Laetoli)
- D. Apes are alive today! Both apes and humans have apparently evolved from some ape-like (or human-like???) common ancestor.
- E. Biologically connected (related), i.e., evolved
- F. Connected via some common ancestor (neither ape nor human, but w/ traits common to both)
- G. Their fossils are of the same age.
- H.
 - 1. brow ridges reduced, along w/ increased forehead volume
 - 2. chin protruding forward

SUGGESTED SEQUENCE FOR "Comparative Anatomy of Hominoid Skulls and Evolution"

1. Unit on Classification (survey of life, taxonomy terms & concepts; problems of classification (misfits))
2. Day 1: Intro to "Bones Study" (have students, in small groups, study and answer questions about any bones you can get, just to get them used to handling and thinking about skeletons, bones, and what bones can tell us. See next page for a sample worksheet: "Comparative Anatomy of Vertebrate Bones")
3. Day 2: Discuss "Bones" lab and questions; Introduce "Skull Comparisons":
Using the Data Sheet and the first day skulls (A-D), go over the items, showing them on the skulls, and commenting on them; show what and how to measure.
HW: study skull diagrams and descriptions (and color?)
4. Lab prep: (assuming 32 students, 4/team, 8 teams, one tray per team) in each tray, have: skull on soft foam pad, calipers, ruler, 2 cardboard sheets, ID letter
5. Day 3: Students do Skull Comparisons with skulls A-D (chimp, gorilla, modern human, Cro-Magnon)
Have them to work in groups of 3-5, spending about 10 minutes w/ their skull, then move tray w/ materials to next team, so the 4 skulls are rotated through 4 teams (2 of each skull works best; if you only have one of each, then use skulls E-H (*Australopithecus africanus*, *A. boisei*, *Homo erectus*, and Neanderthal) this same day for the other four teams.
HW: If time, hand out "Chronology" assignment, and show how to start it for HW
6. Day 4: Do Skull Comparisons with skulls E-H (or with the set of 4 skulls not studied the previous day)
This usually goes faster, so you might be able to begin the Summary.
Begin Summary and Analysis sheets. Summary is best done with teams giving input to you as you enter summary data on overhead.
HW: finish "Chronology" assignment
7. Day 5: Finish Summary; students can count "A's" and "H's", then you can ask them if they see the pattern (generally increasing "H's" and decreasing "A's", going left to right). Point out how the left to right sequence (H-D) matches fairly close to the existence of those species through time (their chronology). Also, point out the "spotty" (mosaic) yet gradual nature of the changes reflected in the trends. Discuss topics on "Skull Analysis" sheet if not already done.
INTERESTING EXTENSIONS: Skeletal evidence for age, male/female diff., primate/non-primate, reconstruction:
 - Age: (3rd molars erupted? cranial sutures: degree of fusion)
 - Male/Female diff.: bone thickness, size of teeth, pelvis shape; experts: 80-90% accuracy
 - Primate/non-primate: primates have nails, not claws; also have closed eye sockets
 - Apes/monkeys: Monkeys have tails, apes don't (most obvious difference)
 - Reconstruction: if possible, show pictures of different reconstructions (artistic renderings) of specific hominids, e.g. Neanderthal, *A. robustus* (*A. boisei*), *Homo erectus*; most influential features have least evidence in bone materials (shape of nose, ears, lips, hair distribution)
 - Teeth: Long canines in primates: used for protection, male competition, not for food.HW: Review all Comparative Anatomy of Hominoid Skulls material
8. Day 6: Give quiz on Comparative Anatomy of Hominoid Skulls
Begin Karyotype Comparison (reading and check questions)
9. Day 7: Quiz feedback; Do Karyotype Comparison (comparative anatomy of chromosomes).
If you haven't studied cells or chromosomes yet, you might have them look at slides (microscope or projection slides) of onion root tip sections and *Drosophila* chromosome squashes.
10. Day 8: Begin Molecular (DNA/protein) comparison activity
11. As a final wrap up, point out how three independent lines of study all point to the same pattern of similarities in hominoids, suggesting a biological relationship from gradual changes (evolution)

Names: _____ sn _____
 _____ sn _____
 _____ sn _____
 _____ sn _____

Date _____ Per. _____

COMPARATIVE ANATOMY OF VERTEBRATE BONES

You will work in teams as assigned. Two people will have assigned duties, and this assignment will rotate with other team members for each bone.

- Recorder: records the final TEAM answer to each question in data table
- Leader: keeps team on task, focused on discussing the questions and getting consensus

Your team will be given a bone to study. Pretend you found this bone in the desert or on the beach, or in a forest. Discuss the features of your bone, compare your bone with those in the diagrams provided, and try to arrive at a consensus for your answers to the following questions about your bone. When asked to shift, pass your bone tray to the next team, as directed, and repeat the above process.

Here are the names of some of the main bones and bone parts in vertebrates to check:

- Skull bones: cranium, upper jaw, mandible, orbit (eye socket), foramen magnum
- Post cranial bones: vertebra, rib, scapula, pelvis, humerus, radius, ulna, carpals, metacarpals, phalanges, femur, tibia, fibula, tarsals, metatarsals

RESOURCES: Your text, pp. 473-5, 482; other texts in room (use index), diagram packets

SKELETONS TO CHECK: Human, horse, frog

For each bone, decide on the most probable answer, based on use of resources and discussion.

	First Bone	Second Bone	Third Bone	Fourth Bone
Bone #				
Bone name				
Animal from which bone came				
Part of anatomy where bone is found				
Adapted for what activity?				

DISCUSSION:

1. What do members of your team know now that they did not know before the exercise?

2. What was hardest to find or figure out for each bone? Why?

3. Did your results for a given bone match the results of other teams?

4. What did you learn from results of other teams?