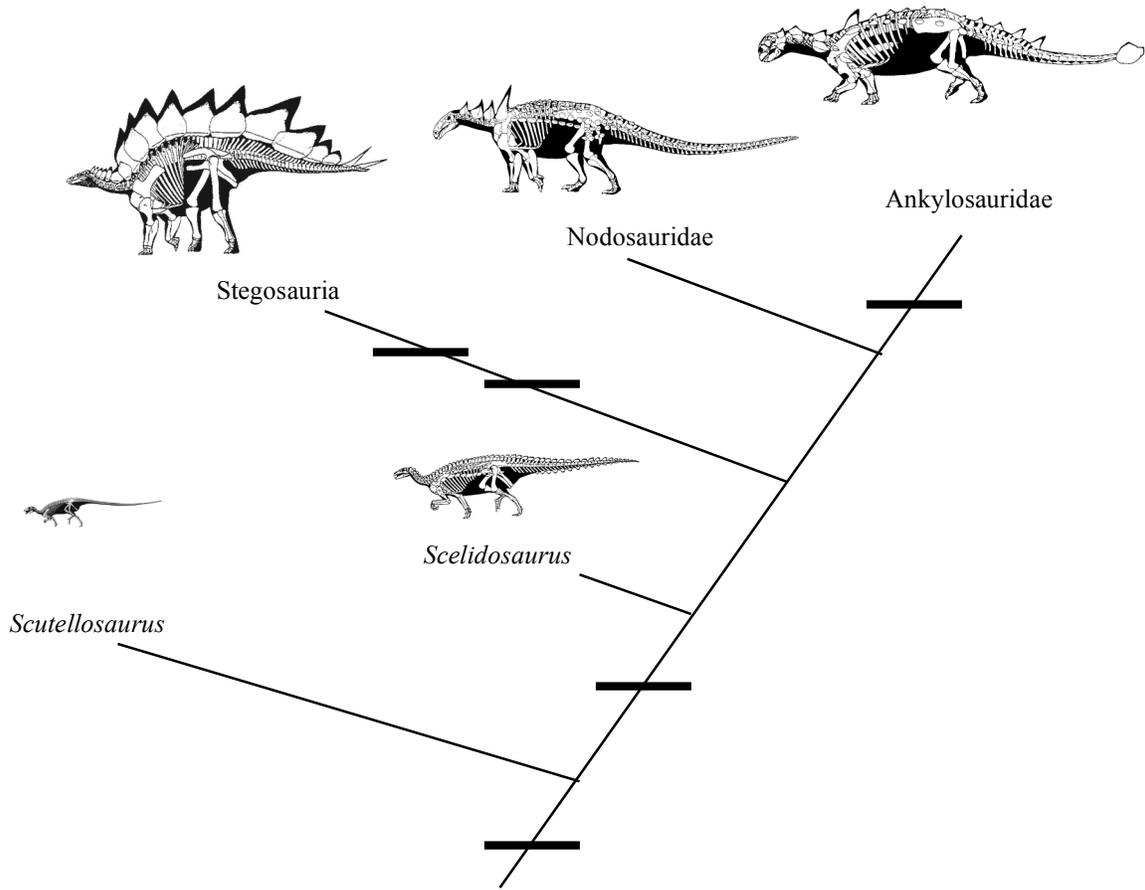


Name: \_\_\_\_\_  
 UID: \_\_\_\_\_

GEOL 104 Dinosaurs: A Natural History  
 Homework 4: Dinosaur Relationships

DUE: Fri. Nov. 2

Questions 1-8 refer to the thyreophoran cladogram below. The skeletal restorations are approximately to scale.



Put the numbers of shared derived characters listed below at the mark showing where they originate on the **cladogram** above:

- 1. Osteoderms
- 2. Obligate quadrupedality
- 3. Paired plates and spikes
- 4. Tail club
- 5. Thagomizer

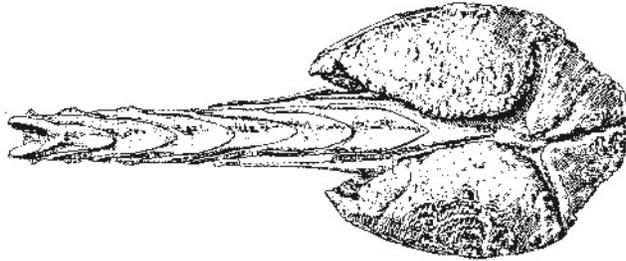
Indicate where the following names belong on the cladogram above:

- 6. Thyreophora
- 7. Ankylosauria

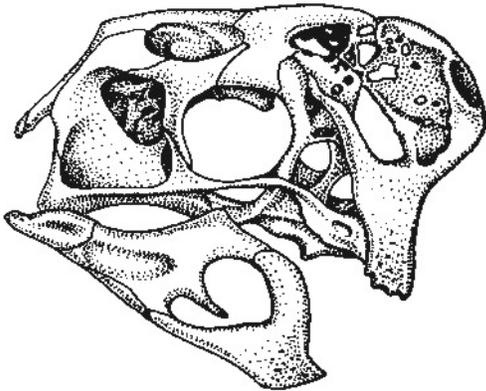
8. What is the hypothesized diet of all the dinosaurs in the cladogram above?

Name: \_\_\_\_\_  
UID: \_\_\_\_\_

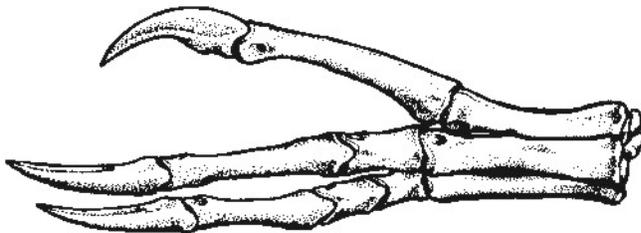
For questions 9-19, answer the questions referring to the illustrations immediately above them. Where given a choice in brackets, circle the correct answer.



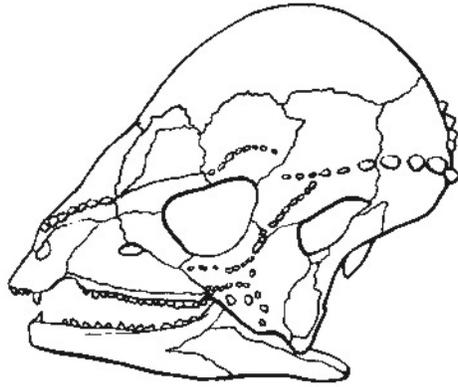
9. The above tail (in dorsal view) is from a [ stegosaur | ankylosaurid | hadrosaurid ].  
10. The primary function for this tail was [ to obtain food | as active defense | to help it run faster ].



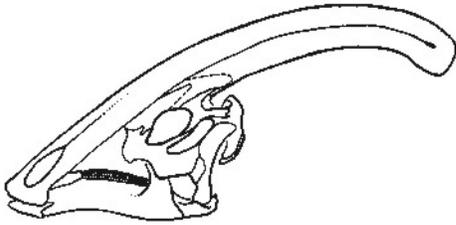
11. The skull shown above is from a [ oviraptorosaur | coelophysoid | lambeosaurine ].  
12. This taxon had a diet primarily of [ meat | plants | probably both meat and plants ].



13. The manus above is from a(n) [ tyrannosaurid | ornithomimosaur | hadrosauriform ].  
14. This taxon is a [ ceratosaur | carnosaur | coelurosaur ].

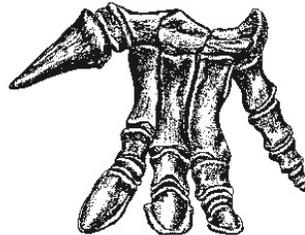


15. The skull above is from a [ brachiosaurid | pachycephalosaur | ceratopsian ].
16. The thickened dome of bone over the skull was most likely for  
[ protection | killing prey | competition between members of the same species ].



17. The skull above is from a [ hadrosaurine | lambeosaurine | ceratopsine | centrosaurine ].
18. The skull above is from a(n) [ marginocephalian | ornithomimid | thyrophoran ].
19. The skull above is from a(n) [ ornithischian | saurischian ].
- Extra Credit) The diet of the dinosaur shown above was most likely [ meat | plants ].

For questions 20-24, identify which of the objects below is from a **hadrosauriform**, which is from a **tyrannosaurid**, and indicate the **arctometatarsus** and the **opposable digit V** on the appropriate fossil. (NOTE: these are NOT too scale).



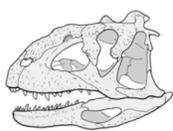
Below is a list of feeding adaptations found in dinosaurs. For questions 25-28, match the letter of the description to the appropriate adaptation.

- |                             |       |  |
|-----------------------------|-------|--|
| 25. Pleurokinetic hinge     | _____ | A. Slicing through tough vegetation.               |
| 26. Grinding dental battery | _____ | B. Shock absorber against struggling prey.         |
| 27. Shearing dental battery | _____ | C. Allows sides of face to move back-and-forth.    |
| 28. Intramandibular joint   | _____ | D. Gnaw low-lying vegetation in front of the face. |
|                             |       | E. Grind food down into little bits.               |

For questions 29-32, indicate which of the feeding adaptations above is a shared derived character of the clade listed.

29. Neotheropoda: \_\_\_\_\_  
 30. Hadrosauridae: \_\_\_\_\_  
 31. Ornithopoda: \_\_\_\_\_  
 32. Ceratopsidae: \_\_\_\_\_

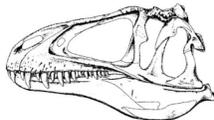
Below are the skulls and skeletons of four big theropods.



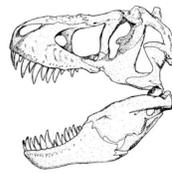
*Majungasaurus*, Abelisauridae



*Suchomimus*, Spinosauridae



*Acrocanthosaurus*, Carnosauria



*Tyrannosaurus*, Tyrannosauridae

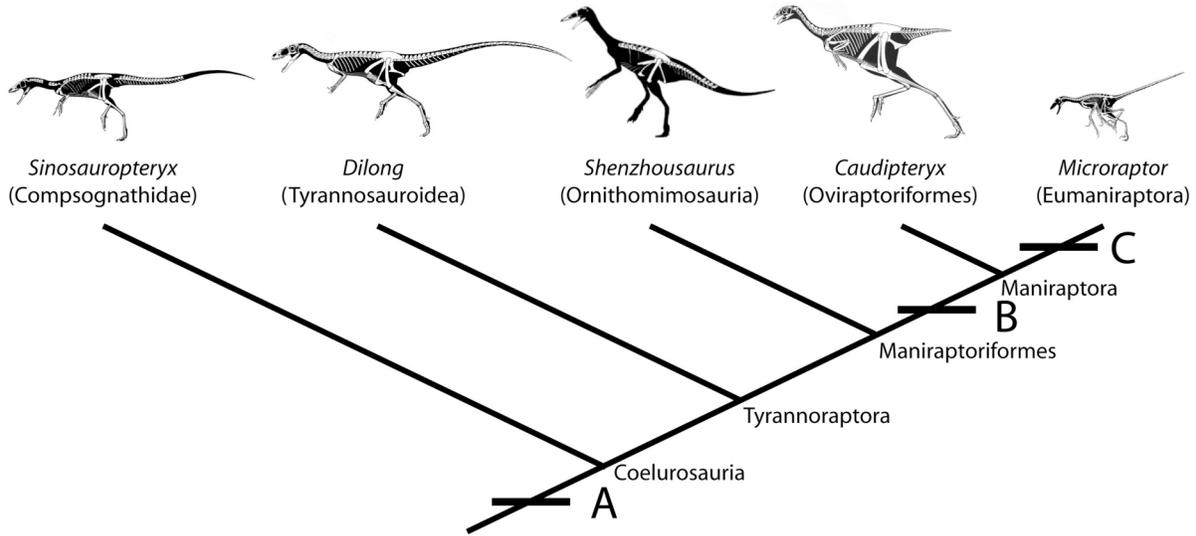
Match the letter of the description below of the appropriate predatory adaptations to the dinosaur name.

- |                             |       |                          |       |
|-----------------------------|-------|--------------------------|-------|
| 33. <i>Acrocanthosaurus</i> | _____ | 34. <i>Majungasaurus</i> | _____ |
| 35. <i>Suchomimus</i>       | _____ | 36. <i>Tyrannosaurus</i> | _____ |

- A. Long snout, conical teeth, powerful thumb claw for grabbing fish as well as other dinosaurs.
- B. Fused nasals, deeply-rooted very large thickened teeth, solid palate for grasping and holding onto prey, tearing out flesh, and breaking bone.
- C. Fused nasals, small thick teeth, rounded skull for grasping prey.
- D. Blade-like teeth for slicing through meat, powerful forelimbs for grasping onto prey.

Extra Credit) Two of the above dinosaurs have forelimbs that were almost certainly not used to capture prey. List each for +1 extra credit.

Below are the skeletons of the small primitive members of several coelurosaur groups (shown pretty close to scale) arranged in their cladogram.

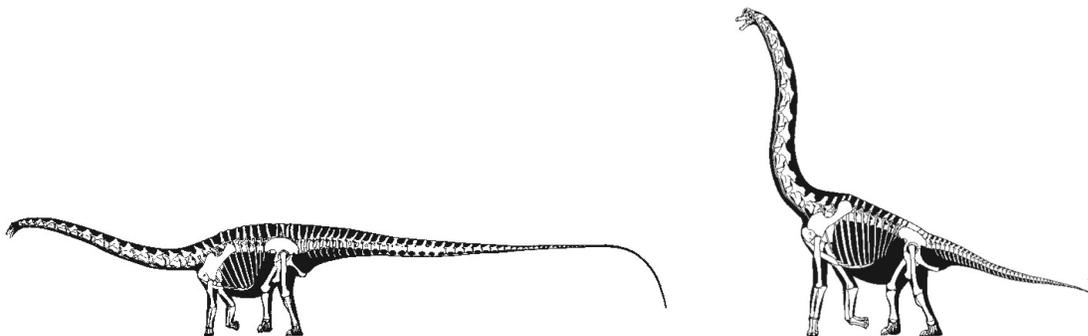


For questions 37-39, indicate which letter above indicates the position on the cladogram where the listed derived trait evolved.

37. \_\_\_\_\_ Broad feathers on the arms and legs, enlarged ossified breastbone, sideways oriented shoulder joints, semilunate carpal
38. \_\_\_\_\_ Protofeathers, slender hand, boat-shaped chevron
39. \_\_\_\_\_ Elongate leg feathers, tail very mobile at base and stiffened distally

40. While the early examples of each of the coelurosaur clades listed were all small, most of those lineages produced giants of 1 ton or more. Not all of them did, though. List one of the clades that never produced a 1 ton or greater giant, with extra credit for another.

Sauropod dinosaurs evolved numerous approaches for feeding high in trees. Below are pictures of the diplodocid *Diplodocus* and the brachiosaurid *Brachiosaurus* (to scale). Match the dinosaur with the number of its tree-feeding strategy.



41. Built uphill, unlikely to have reared up.
42. Able to rear onto its hind legs.