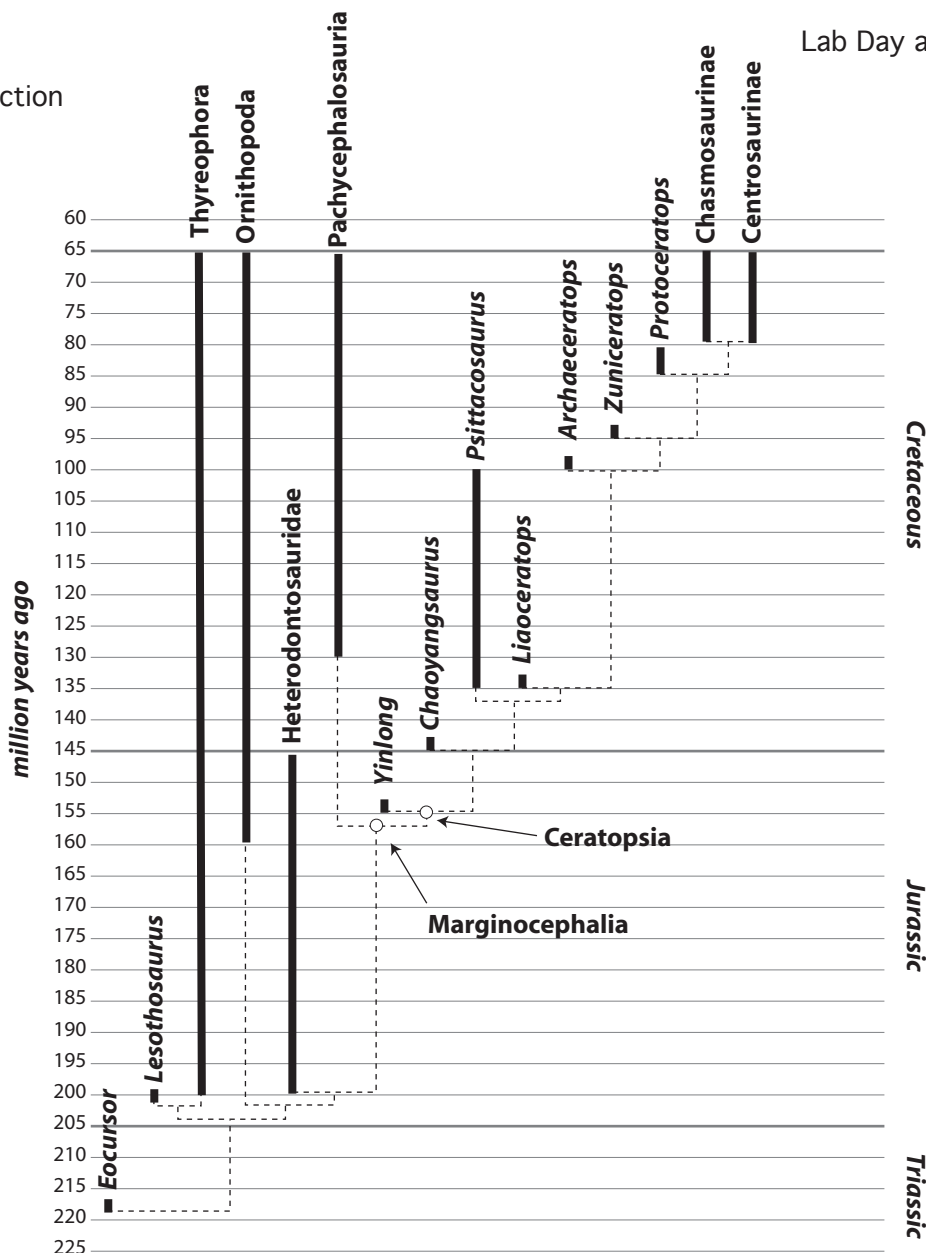


Lab Exercise 5
Phylogenetic Prediction
and Bracketing



Above is a cladogram showing the relationships among ornithischian dinosaurs and their stratigraphic distribution. Some of these are new discoveries from China and Mongolia (*Yinlong*, *Chaoyangsaurus*, *Liaoceratops*, *Archaeoceratops*) or western North America (*Zuniceratops*).

1. Pachycephalosaurs first appear in the fossil record 130 million years ago, but based on this diagram, how far back in time (minimally) must their lineage go?
2. Marginocephalia first appears in the Late Jurassic (approximately 155 million years ago), but how far back (minimally) must the group extend?
3. Which group has a ghost lineage extending back to the same time?
4. What was the age of first appearance for Marginocephalia before the discoveries of *Chaoyangsaurus* and *Yinlong* in 1999 and 2006, respectively?
5. Would you predict marginocephalians found in rocks 180 million years in age to be bipeds or quadrupeds? Why?

On the following page is a cladogram showing how some dromaeosaurid theropods are related to each other. Dromaeosauridae is the group including the *Velociraptors* from Jurassic Park. Several new discoveries are included, including one – *Mahakala* – announced about two months ago.

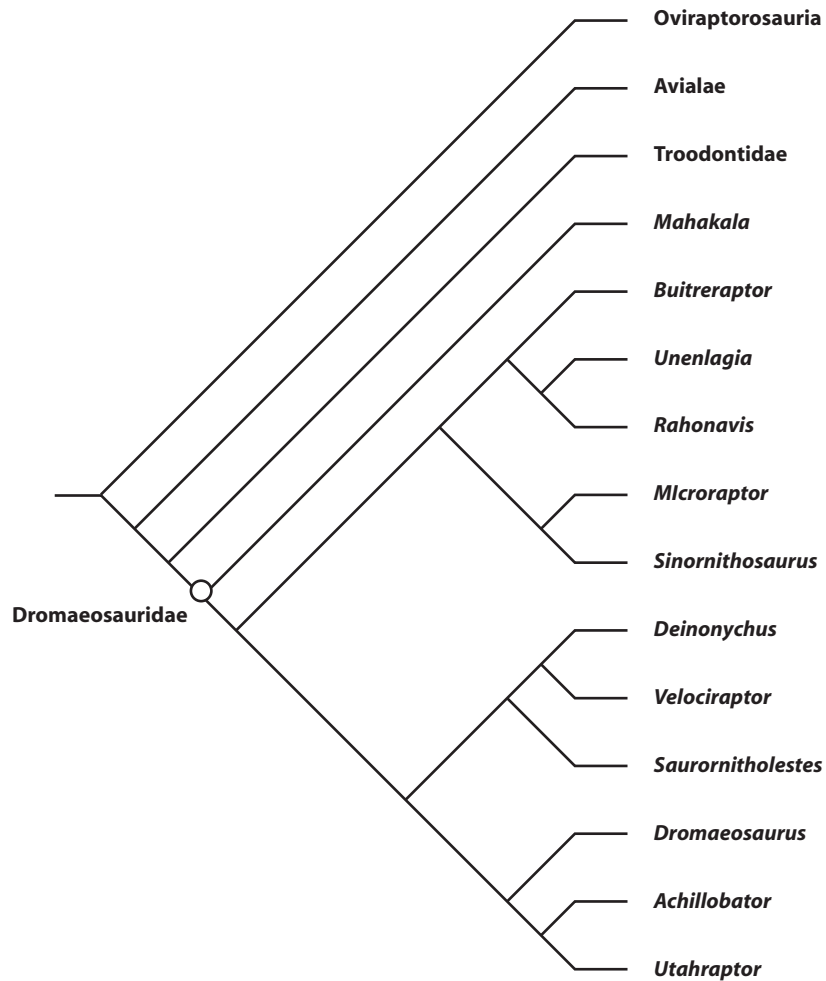
6. The popular image of dromaeosaurids is of savage creatures with an enlarged “switch-blade” claw on the second toe of the foot. But based on the character state distributions shown in the matrix, why can’t we state that dromaeosaurids are animals with switch-blade toe claws? (In other words – is the enlarged toe claw a synapomorphy of Dromaeosauridae?)

7. Is there another character shown in this matrix that might be a better character we can use to describe dromaeosaurids?

8. The *Velociraptors* of Jurassic Park were about the size of a human, but real *Velociraptor mongoliensis* was not much bigger than a domestic turkey. The largest of the dromaeosaurids (*Utahraptor* and *Unenlagia*, which actually were human-sized) were both discovered after Jurassic Park was released. Did the makers of Jurassic Park have phylogenetic reason to expect the future discovery of human-sized dromaeosaurids, or did they get lucky?

9. The feet of *Buitreraptor* and *Saurornitholestes* are both largely unknown. Based on the phylogeny, would you expect enlarged toe claws in either of them?

10. Shortly after the paper describing *Mahakala* was published in 2007, the same group of authors announced evidence that *Velociraptor* had feathers. They didn’t actually find the feathers themselves – only knobs on the radius that may have supported feathers, similar to knobs found in modern birds. Based on the phylogeny, would you predict feathers on *Velociraptor* even if the knobs had never been found?



	enlarged claw on second toe?	reinforced tail?	feathers?	size?
Oviraptorosauria	no	no	yes	small (ancestrally)
Avialae	no	no	yes	small (ancestrally)
Troodontidae	no	no	yes	small
<i>Mahakala</i>	no	yes	?	small
<i>Buitreraptor</i>	?	yes	?	small
<i>Unenlagia</i>	no	?	?	large
<i>Rahonavis</i>	no	yes	?	small
<i>Microraptor</i>	no	yes	yes	small
<i>Sinornithosaurus</i>	no	yes	yes	small
<i>Deinonychus</i>	yes	yes	?	small
<i>Velociraptor</i>	yes	yes	?	small
<i>Saurornitholestes</i>	?	yes	?	small
<i>Dromaeosaurus</i>	yes	yes	?	small
<i>Achillobator</i>	?	yes	?	small
<i>Utahraptor</i>	yes	?	?	large