

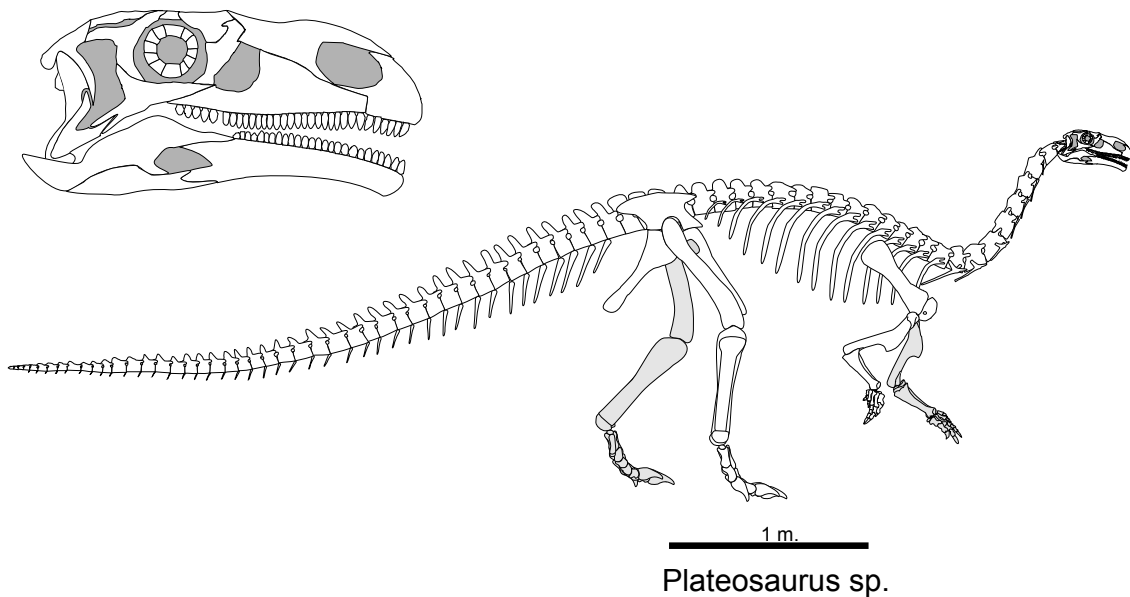
## Geo 302D: Age of Dinosaurs

### LAB 7: Dinosaur diversity- Saurischians

Last lab you were presented with a review of major ornithischian clades. You also were presented with some of the kinds of plants that ornithischians faced on a daily basis. This lab takes a look at the other great dinosaur lineage, the sister taxon to Ornithischia, **Saurischia**.

The ancestral saurischian possessed a suite of synapomorphies derived over the ancestral dinosaur. See your CD to review these and all synapomorphies of smaller saurischian groups. The ancestral saurischian gave rise to two distinct lineages, **Sauropodomorpha** and **Theropoda**.

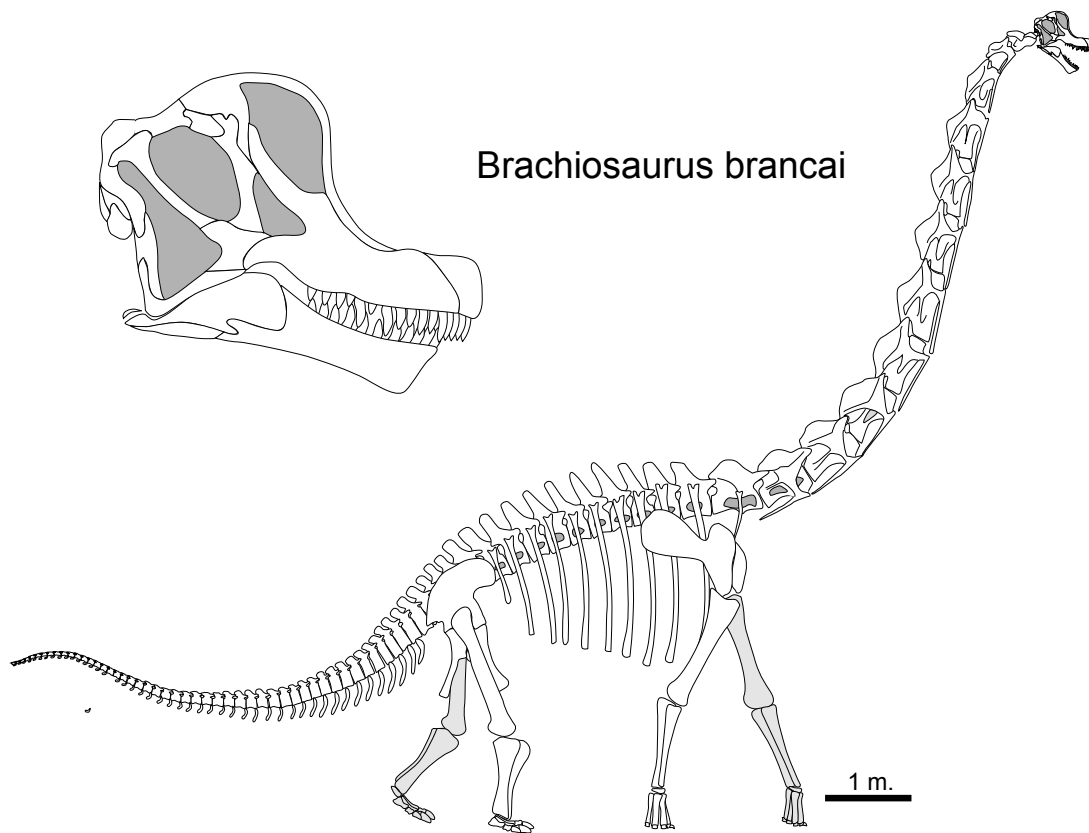
Sauropodomorpha differs from its ancestors in that members of this clade adapted to an herbivorous diet. As a result, they shared the same advantages and disadvantages as their ornithischian cousins. Like ornithischians, sauropodomorphs developed small, blunt teeth better suited for dicing plants than for tearing meat. Unlike ornithischians, sauropodomorphs never evolved complex, efficient grinding teeth. Evidence suggests that they compensated for this by using gastroliths to mechanically break down large volumes of plant material. Although the pubis of sauropodomorphs is not backturned, the deep ribcage probably housed an extensive gut system able to house quite a large bacterial colony to aid in breaking down cellulose.



The earliest sauropodomorph fossils are known from Late Triassic sediments around the globe. These primitive forms retained the bipedal stance of their ancestors, but decreased the size of their skulls and teeth. The hands no longer bore large claws for grasping prey. *Plateosaurus* (the skeleton above) is one of the best known primitive sauropodomorphs. It is a relatively large animal by today's standards, roughly six to seven meters in length.

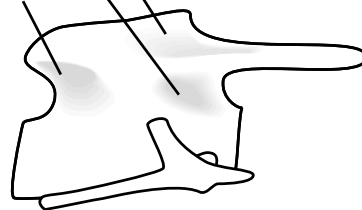
As sauropodomorphs diversified, they also increased in size. From basal sauropodomorphs like *Plateosaurus* arose members of **Sauropoda**. Sauropods include the largest terrestrial animals of all time. During much the twentieth century many paleontologists assumed these animals were too large to have effectively supported their weight on land. That is why many older textbooks and children's books show huge sauropods standing chest or head-deep in water, wallowing about like giant hippos. Today we know that the sauropod body plan was superbly designed to bear the animal's great weight on dry land.

Like many saurischians, the vertebral column of sauropods is lightened by pleurocoels. Pleurocoels are simply hollow spaces excavated into the sides of a vertebra. Some modern hypotheses suggest they were filled with pneumatic air sacs. Modern birds have extensive air-sac filled pleurocoels. Sauropods take their pleurocoels to an extreme. The body of the vertebra is little more than an I-beam in cross section. This affords great strength and weight reduction.



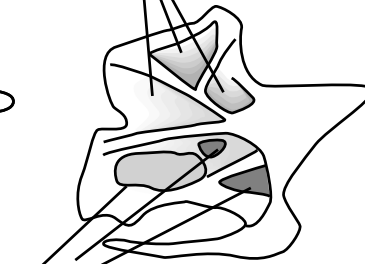
Pleurocoels of sauropodomorph cervical vertebrae

weakly-developed pleurocoels



Plateosaurus

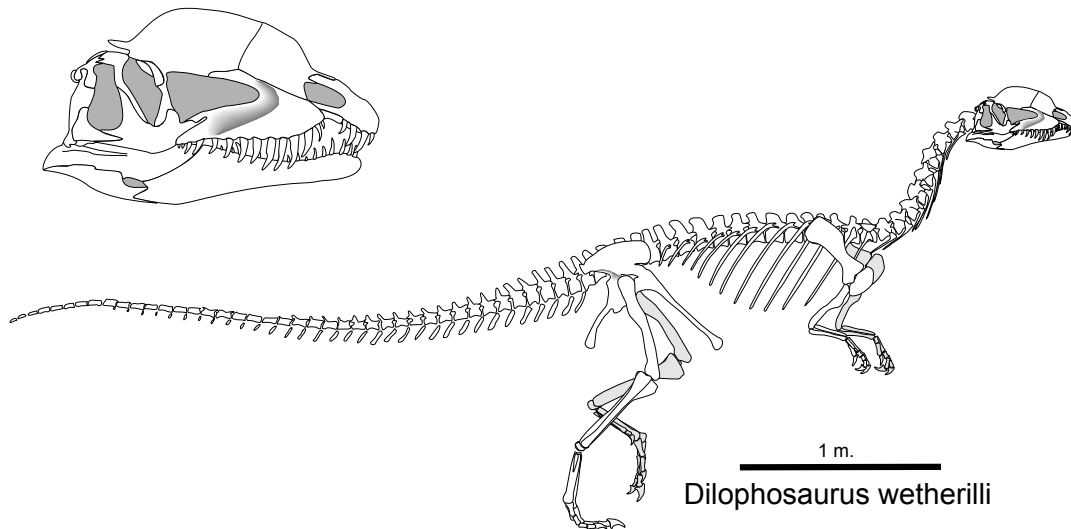
deep pleurocoels



deep pleurocoels

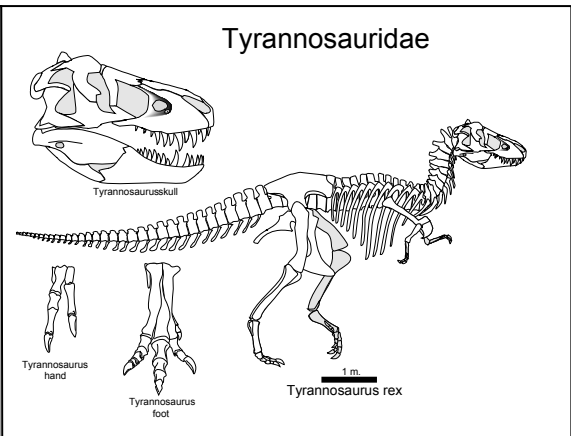
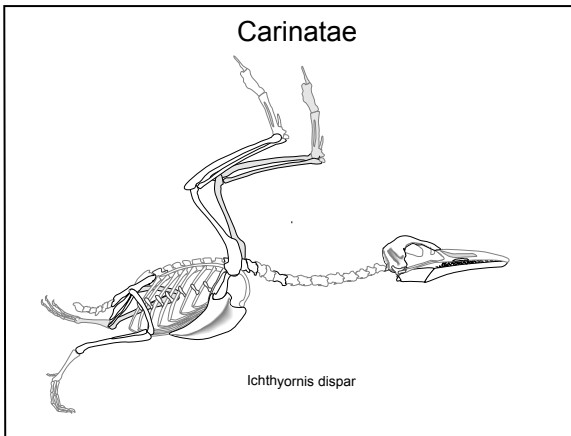
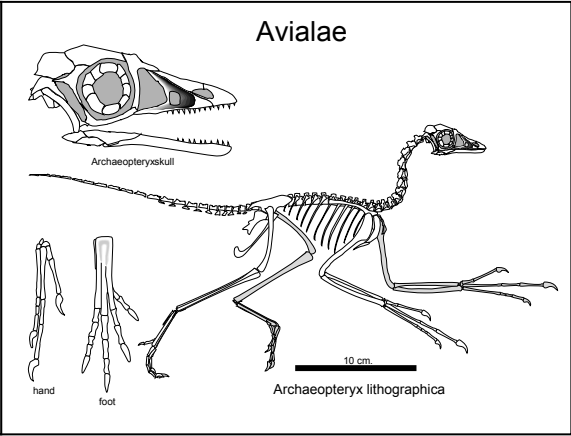
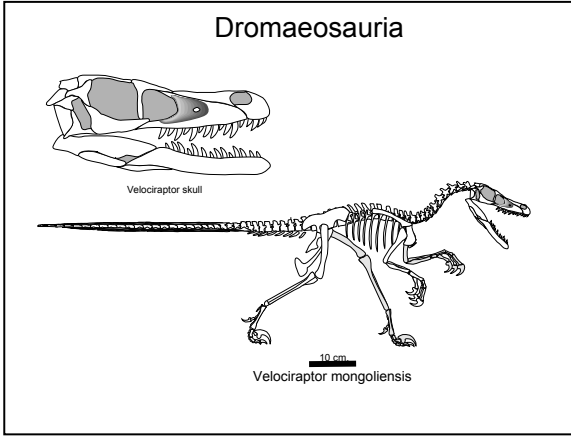
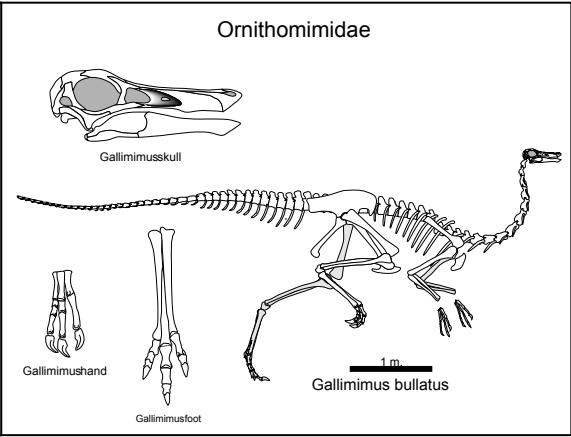
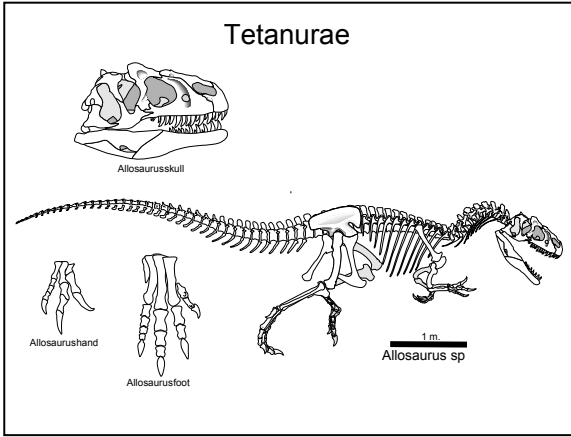
Sauropoda

Theropoda is the other saurischian lineage. There are many synapomorphies for this clade and you must know them all. Theropods retain their ancestral diet of meat. They range in size from a few grams (hummingbirds) to many tons, and even though some are larger than many quadrupedal dinosaurs, they all retain their bipedal mode of locomotion. There are two main lineages within Theropoda, **Ceratosauria** and **Tetanurae**.



The fossil record of Ceratosauria begins in the Late Triassic, and includes some of the oldest dinosaurs for which good fossils are known. *Coelophysis* is the best known of all Late Triassic theropods. A cast of the skeleton of this taxon is on display in the hallway on the first floor. Ceratosaurians ranged in size from lightly built individuals little more than a meter in length, to very large forms measuring ten or more meters long. Ceratosaurians are recognized by extensive fusion of bones in the ankle, hips, foot, and sacrum. These same features are converged upon millions of years later by another theropod lineage, birds. Many species of ceratosaurians sport elaborate cranial crests, horns, or knobs. You can see this clearly on the skull of *Dilophosaurus*, a six meter long ceratosaur from Early Jurassic aged rocks of Arizona. Some derived ceratosaurians survived in Gondwana until the end of the Cretaceous. One that exhibited extensive cranial ornamentation was *Carnotaurus*, from the Late Cretaceous of South America. Instead of delicate crests, *Carnotaurus* has two massive pre-orbital horns. All ceratosaurians became extinct by the end of the Cretaceous Period.

Tetanurae is the sister taxon to Ceratosauria. The earliest fossil record of this group extends back into the Early Jurassic, and the clade survives to the present day. Tetanurines include most of the more famous theropods, such as tyrannosaurs, dromaeosaurs, and allosaurs. The tetanurine lineage shows several trends as it proceeds to more and more derived forms. Some tetanurines evolved slashing claws on the second toe of each foot. Others have an uncanny resemblance to modern paleognath birds (ostriches, emus, rheas, etc.). We now know that feathers appeared in some tetanurine group phylogenetically before the appearance of *Archaeopteryx*. There are a great many clades nested within Tetanurae, and you must know the relationships and synapomorphies diagnosing them all. The skeletons on the following page give you just a slight glimpse at the great diversity of tetanurines.



## Exercises

1. Look at the skeleton of *Gallus gallus* (Chicken) on the next page. Identify **one** synapomorphy that you can see in this skeleton from each of the groups listed below. Label each synapomorphy on the skeleton as well.

a.) Archosauriformes \_\_\_\_\_

b.) Saurischia \_\_\_\_\_

c.) Theropoda \_\_\_\_\_

d.) Coelurosauria \_\_\_\_\_

e.) Maniraptora \_\_\_\_\_

f.) Avialae \_\_\_\_\_

g.) Ornithurae \_\_\_\_\_

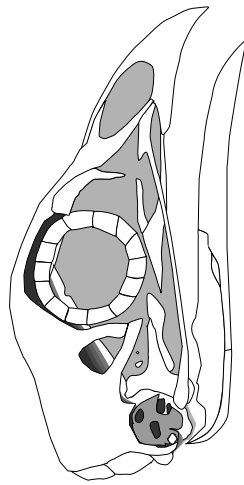
h.) Ornithothoraces \_\_\_\_\_

i.) Carinatae \_\_\_\_\_

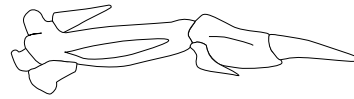
j.) Aves \_\_\_\_\_

2. Examine the cast of *Archaeopteryx*. See if you can identify any of the synapomorphies of the following groups in its skeleton: Theropoda, Coelurosauria, Maniraptora, Archosauria, Saurischia, and Archosauriformes.

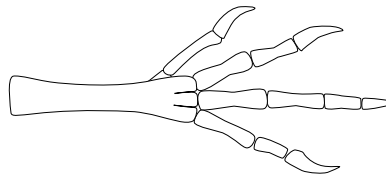
# Neognathae



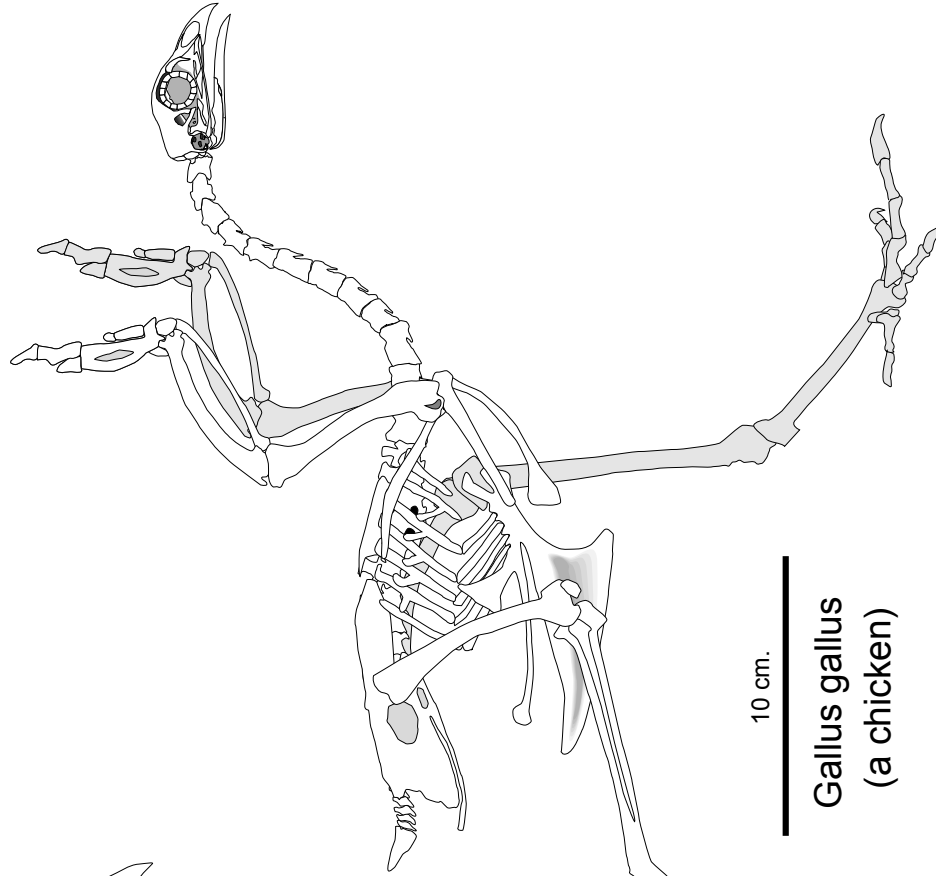
Gallus skull



Neognath hand



Neognath foot



10 cm.

Gallus gallus  
(a chicken)