The Dinosaur: Dragon or Doofus?

Dinosaurs in the Public Eye

No other extinct group of animals have attracted as much public fascination as the dinosaurs.

Why ?

- Many were big
- They look neat
- They're dead

- Add your own reason(s)

Dinosaurs and Myth

It is very possible that dragon myths and legends were spawned, in part, by early discoveries of dinosaur remains.

Very few legends are based on pure imagination.

Superficially, dragons do look quite a lot like dinosaurs.

Dragons are typically depicted as large reptilian beings (although with added accessories such as wings and the ability to breathe fire)

An interesting aspect of dragon mythology is that the image of the dragon is so widely distributed over different cultures (from eastern Asia to the Americas).

This may, in part, reflect the widespread distribution of dinosaur remains (found on all continents),

Dragons hold a place of honor and prominence in Chinese folklore, including in the story of the "Dragon's Pearl". This may relate to the fact that dinosaurs are plentiful in several regions of China.

Dinosaur-like creatures in Modern Popular Culture

Godzilla (a corruption of "Gojira")
Gojira: from Japanese
(Gorira=Gorilla) and (Kujira=Whale)

Original Godzilla
(Gojira (1954), King of the Monsters, (1956))
Synposis: A 50 m tall, fire-breathing "dinosaur" wakes from undersea hibernation off the Japanese coast as a result of atomic bomb testing - attacks Tokyo. Played into Japanese fear of nuclear attacks and widespread destruction of their cities.

Godzilla (1998)
Synopsis: Giant, mutant lizard is created by French atomic testing in the South Pacific. The creature makes its way to Manhattan and proceeds to ravage the city.

And Barney

Root canal, anyone ?

Of Course: Jurassic Park (and Sequels)

Successfully updated the image of dinosaurs in the minds of the public according to recent scientific thought--dinosaurs were no longer regarded to be the slow, dumb brutes of classic interpretations.

Dinosaur Ancestry

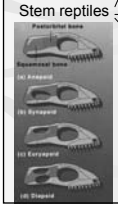
The most primitive reptile group (which first appeared in the Carboniferous Period) is what is commonly termed the "stem reptiles" – small, lizard-like forms that evolved from amphibians.

These laid eggs which were relatively tough and rigid and contained a fluid-filled sac (the amnion) which surrounded the embryo. This allowed these transitional forms to reproduce on land. Other adaptations (e.g. scales) allowed the earliest reptiles to entirely break ties with aquatic environments.

Hylonomus (a stem reptile) in a hollow lycopod tree stump.
Carboniferous, Joggins, Nova Scotia

By the Permian-Triassic, three groups branched off from the "stem reptiles"

Stem reptiles



Mammal-like reptiles (which evolved into mammals)

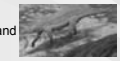
Mammal-like reptile

Marine reptiles (e.g. icthyosaurs, pliosarus and plesiosaurs)

Ichthyosaur

All other reptiles, with two subgroups:

The squamates (lizards and snakes).



Thecodont

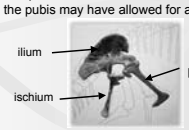
The archosaurs (thecodonts, crocodiles, dinosaurs and birds)

How Dinosaurs Are Classified

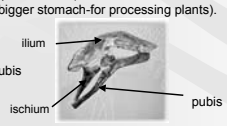
Two major groups (orders) of dinosaurs are recognized, based on hip structure.

There are three bones in the hip/pelvis (ilium, ischium and pubis).

Saurischian ("lizard-hipped") dinosaurs had a backward facing ischium And forward-facing pubis. Both meat-eating and plant-eating forms are known.
Ornithischian ("bird-hipped") dinosaurs had a backward facing ischium and pubis. All ornithischians were plant eaters (the backward rotation of the pubis may have allowed for a bigger stomach-for processing plants).



Saurischian (*Allosaurus*)



Ornithischian (*Stegosaurus*)

Changes in Posture

The success of the dinosaurs can, in part, be attributed to the development of an upright posture.

Stem reptiles (and lizards) have a sprawling posture similar to that of their amphibian antecedents; this limits mobility and breathing (body and lungs are deformed during walking).

Thecodonts eventually attained a semi-upright posture that allowed for better mobility. Later forms developed a nearly full upright posture.

Dinosaurs attained full upright posture (with legs positioned directly beneath the body, allowing for maximum mobility)-- Also prevented torsion of the torso.

Oldest Known Dinosaurs

The oldest known dinosaurs are about 228 million years old, from mid-Triassic rocks in Argentina (actually oldest currently known are about 235-240 million years old and from Brazil). It appears that the earliest dinosaurs were meat-eating saurischians (called theropods). Plant-eating saurischians (called sauropods) appeared by the Late Triassic and ornithischians appeared by the Early Jurassic.

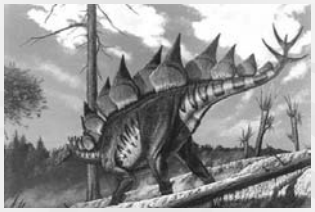
Skull of *Eoraptor* ("dawn thief") from Argentina

Saurischians: Theropods and Sauropods

Theropods (all meat eaters) -bipedal

Sauropods (all plant eaters) -quadripedal

Other well-known Ornithischians



Stegosaurs ("plated" dinosaurs)

Ornithischians

Ornithischian dinosaurs, although all plant-eaters, were extremely diverse in appearance and had very specialized lifestyles.

Ornithopods (e.g. hadrosaurs; duck-billed dinosaurs)

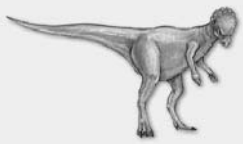
Ornithischians

Ceratopsians (horned dinosaurs)

Ornithischians

Ankylosaurs (armoured dinosaurs)

Ornithischians



Pachycephalosaurs ("bone-headed" dinosaurs)

Dinosaur Nesting Behaviours

Fossil nests of dinosaurs have been found all over the world.

The first documented discovery of dinosaur nest with eggs occurred in the Gobi Desert in 1922 (Roy Chapman Andrews expeditions). Since that time dinosaur nests have been found in numerous localities of various ages around the world.

Many of these finds have indicated that dinosaurs were very good parents !

Many dinosaurs built nests and tended to their young (including feeding them--similar to the way many birds do).

Maiasaura ("good mother lizard")

Oviraptor: egg stealer or caring mother ?

Specimen previously interpreted as *Oviraptor* buried in the act of raiding a nest of *Protoceratops* eggs (eggs later found to contain embryos of *Oviraptor*). It is likely to have been an omnivore--not strictly "oviphagous".

Oviraptor with nest

How Have Dinosaurs Been Misrepresented ?

There are several misconceptions about dinosaurs that have persisted to the present day, mostly due to erroneous comparisons with modern-day lizards (with which they are not directly related). Here are a few of them:

1. Dinosaurs were slow, tail-dragging brutes.
2. Dinosaurs had scaly skin (just like lizards).
3. Dinosaurs were dumb.
4. Pterosaurs were flying dinosaurs.
5. Dinosaurs were cold-blooded (just like lizards).
6. Dinosaurs were dull-coloured
7. Dinosaurs were unsuccessful (hence their extinction).

Myth 1: Dinosaurs were slow, tail-dragging brutes.

"Incorrect" reconstruction

"Correct" reconstruction

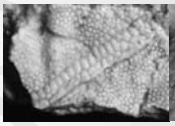
Dinosaur (particularly theropods) are commonly depicted with their tails dragging behind them.

The tail actually had a purpose: to provide a counterweight to the mass at the front (the centre of balance was at the hips)! *Tyrannosaurus* probably reduced the size of its front limbs to offset the huge amount weight at the front of the body in the head.

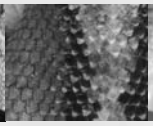
Based on the spacing of footprints in trackways (scaled to the size of the maker of the footprints), it has been calculated that Tyrannosaurus could run as fast as 30 km/hr. Even higher estimates have been proposed.

Myth 2: Dinosaurs had scaly skin (just like lizards)

This misconception also stems from comparisons with modern lizards. Dinosaur skin is rarely preserved. However, skin impressions found so far indicate that dinosaur skin had a pebbled texture like bird skin--very different from lizard skin !



Cast of dinosaur skin impression



Lizard skin

Skin on bird leg

Myth 3: Dinosaurs were dumb.

Dinosaurs weren't rocket scientists.

The brain of *Stegosaurus* was a bit bigger than a walnut, so ranked low on the intelligence scale.

However…some of the smaller theropod dinosaurs such as *Troodon* had much higher brain volume to body volume ratios, well within the range of birds- it is estimated that Troodon may have been as intelligent as a raccoon--that is assuming brain size necessarily relates to intelligence.

It has been speculated that if the Cretaceous-Tertiary mass extinction did not occur, therapod dinosaurs might have been able to evolve into humanoid beings with advanced mammalian-level intelligence (Dale Russell).

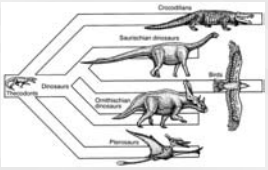
Humanoid Reptile !!!?

Troodon

Myth 4: Pterosaurs were flying dinosaurs.

This is a very common misconception.

Pterosaurs (commonly called "pterodactyls") were reptiles (and belonged to the archosaurs) but belong to a different group (order) than dinosaurs.



Myth 5: Dinosaurs were cold-blooded (just like lizards).

This misconception also stems from the notion that dinosaurs are closely related to lizards (which they are not).

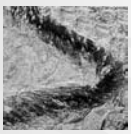
Lizards gain body heat mostly by basking in the sun (to a lesser extent by digesting food) and lose body heat readily. Little attempt is made to conserve body heat. They are ectothermic (cold-blooded) as a result.

Some large dinosaurs may have indeed been cold-blooded, but could have generated lots of body heat by bacterial breakdown of food in their stomachs. In addition heat loss would have been reduced by their low surface-to-volume ratio. Therefore, they could have been endothermic.

However…small theropod dinosaurs show features that closely resemble those of warm-blooded animals such as mammals and birds (e.g. very spongy bone structure and evidence of high levels of activity- as indicated by trackways). On the basis of these similarities it has been suggested that these dinosaurs could have been truly homeothermic.

The most convincing evidence for warm bloodedness in dinosaurs yet uncovered is evidence of an downy body covering (indicating an attempt to conserve heat).

Sinosauropteryx
(Liaoning Province, China)



"dino fuzz"
on *Sinosauropteryx*

Dinosaur Colouration

The Old View

The New View

It is likely that some dinosaurs were dull-coloured -but this probably wasn't true for all of them

Myth 6: Dinosaurs were dull-coloured

Some of these feathered dinosaurs also exhibit long feathers (despite the arms not being long enough to act as wings).

This plumage must have been used for display purposes, and was probably brightly coloured.

Caudipteryx
skeleton

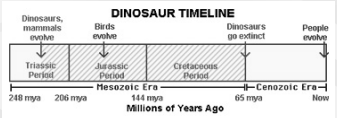
Caudipteryx
(view of tail fan)

Myth 7: Dinosaurs were unsuccessful (hence their extinction).

Note that dinosaurs walked Earth for about 160 million years.

Humans (and their close relatives) have been around for about 5 million years.

Modern humans (*Homo sapiens*) have been around for about 200,000 years (0.2 million years)



In this context, can we say that dinosaurs were unsuccessful? I don't think so!

Adjustments to Midterm test evaluation scheme

The new total for the Midterm is 50.

One or two parts of the test (totaling 20 marks) will be eliminated from the evaluation depending upon your performance on these sections.

The following may be eliminated:

Part 1(10 total) and Part 2 (10 total); 20 combined

OR

Part 3 (20 total)

Part 4 marks will remain unchanged (30 total).

This will produce a new base mark out of 50.

Even with this modification, the class average is still below 50%.

Further manipulations in the grades will need to be made. The nature of this has not yet been decided.

Please check your midterms over, if you have not done so already, with reference to the marking key provided online.

Please have the instructor check any necessary changes by next Tuesday. I will be informing the class of their recalculated mark by the end of next week.

Depending upon your recalculated grade and your performance on the short written assignment, the midterm will be evaluated at 10% or 15% of your final grade.