

GEOL 104 Dinosaurs: A Natural History
Final Review

Review Tests 1 & 2, especially:

Definition of Dinosauria (the ancestor of *Iguanodon* and *Megalosaurus* and all of its descendants)

Proper taxonomic grammar!

What are the relationships between dinosaurs and other tetrapods?

What are the relationships between and important adaptations of the major groups of dinosaurs? (Pay particular attention to those groups who were referred to again during the last third of the course!); Bird origins

What are the major events in dinosaur history?

Evolution & Cladistics (be able to read a cladogram) Geologic time

Dinosaur Functional Anatomy & Behavior

Significance of osteological correlates

Methods of interpreting function & behavior: Analogies with living forms
Phylogenetic distribution of behaviors
Biomechanics
Geological Evidence (tracks, coprolites, bite marks, etc.)

Striding locomotion in dinosaurs

Difficulty in determining top speeds (even for living animals)

Use (and difficulties) of footprints in studying dinosaur locomotion

Cursoriality vs. Graviportal: osteological correlates of each

Scaling issues, allometry: isometry, negative allometry, positive allometry

Which groups of dinosaurs have the most cursorial adaptations? Which the most graviportal?

Changes of locomotion in eumaniraptorans: knee-driven striding

Other types of functional analysis: bite force, digestion, joint motion

Dinosaur Senses and how we reconstruct them: brains, balance, hearing, smelling, vision

Interspecific vs. Intraspecific Behavior

Message of display: Defensive, Territorial, Sexual (courtship), Species Recognition

Medium of display: Visual, Sound, etc.

Examples of dinosaur behavior from the fossil record

Why display?

Gregarious behavior: evidence (direct and inferred); advantages to predators, to prey; disadvantages to living in groups; Kin Selection & Reciprocal Altruism

Sexual strategies; sexual dimorphism

Difficulties in determining sex of dinosaurs

Dinosaur Eggs and Babies

Altricial vs. Precocial Growth

Dinosaur nests, clutches, and nesting patterns

Evidence for parental care; Evidence for **paternal** (fatherly) care in maniraptorans

Evidence for baby dinosaurs in groups

Changes in dinosaur growth (esp. appearance of species-level features in sub-adults)

Skeletochronology & use of Lines of Arrested Growth

How dinosaur growth compares to non-avian reptiles? To mammals?

Dinosaur lifespans

Life-history strategies: K-selected vs. r-selected

Endothermy vs. Ectothermy

	“Warm-Blooded”	“Cold-Blooded”
Energy Source:	Endothermy	Ectothermy
Metabolic Rate:	Tachymetabolism	Bradymetabolism
Temperature over Time:	Homeothermy	Poikilothermy

Resting vs. active metabolic rates; duration of sustained activity; recovery time

Why evolve endothermy? Increased aerobic capacity, greater environmental tolerance, increased metabolic efficiency, help in parental care (pre- and post-natal)

The Aerobic Equation ($C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O + \text{energy}$; or “glucose + oxygen yields carbon dioxide, water, and energy”). How to get extra glucose & oxygen? How to distribute extra glucose & oxygen to cells?

How to get rid of extra carbon dioxide?

Traditional Estimates of Dinosaur Physiology:

Posture	Latitudinal distribution	Feeding adaptations (such as dental batteries)
Relation to birds	Predator-prey ratio	Microscopic bone structure (Haversian canals, reworked bone)
Insulation		

Non-traditional Physiologies:

Gigantothermy Heterometabolism (Ontogenetic and Behavioral)

Respiration in Mammals vs. Crocs vs. Birds vs. other tetrapods. Belly-breathing in basal archosaurs (and at least some dinosaurs?); One-way lungs in Archosauria; Air sac breathing in at least Saurischia. Other variations of respiration (in Ornithischia, in Pterosauria).

Function of four-chambered hearts, and evidence for such in dinosaurs.

Nasal Turbinates, and significance of enlarged nares in bigger/more derived dinosaurs.

Significance of higher oxygen and carbon dioxide levels, and higher plant productivity, in Mesozoic

Other organisms of the Mesozoic

Pterosauria: basic adaptations, especially for flight and for physiology

“Rhamphorhynchoidea” vs. Pterodactyloidea. Terrestrial locomotion; feeding

Mesozoic marine reptiles: why would an amniote return to the sea? What problems would they face; what sort of adaptations would they need?

Know the basic adaptations (especially feeding, locomotion, and reproduction) and be able to identify:

Mesosaurs; ichthyosaurs; placodonts; plesiosaurs (both plesiosauroid and pliosauroid); mosasaurs; marine crocodiles; sea turtles; hesperornithids

Mesozoic mammals: Origins; diversity; major adaptations; major groups: monotremes, multituberculates, therians (eutherians (placentals and our ancestors) plus metatherians (marsupials plus their ancestors)

Mesozoic plants: Photosynthesis ($6 CO_2 + 6 H_2O + \text{sunlight} \rightarrow C_6H_{12}O_6 + 6 O_2$). Basic adaptations. Difference between spore plant, gymnosperm, and angiosperm reproduction. Angiosperm origins in Cretaceous: what are the co-evolutionary partners and function of flowers and fruit?

The K/Pg Extinction

Be familiar with the following groups and their fate relative to the K/Pg Extinction:

Marine life: Coccolithophorids; foraminiferans; ammonoids; belemnoids; rudists; inoceramids, the various marine reptiles

Terrestrial life: Plants, insects, amphibians, turtles, tuataras, lizards (incl. snakes), crocodylians (incl. various non-aquatic types), champsosaurs, pterosaurs, the various mammals

Definitions:	Extinction	Mass extinction	Maastrichtian	Campanian
	“Tertiary”	Paleogene	K/Pg extinction	

Hypotheses of extinction: What evidence exists for different causal agents of extinction?

How might each have caused the event?

Why some old extinction models don't work

Good evidence for: Volcanism: esp. Deccan Traps (India)

Asteroid impact:

Iridium layer at Gubbio, Italy

Shocked quartz, melt glass, tsunami deposits, ejecta deposits, etc.

Crater at Chicxulub (Yucatán)

Maastrichtian Regression

What is the environmental impact of each of those agents? The effects and timing of each? What does the magnetostratigraphic record say about the timing of Deccan Traps and the Chicxulub Impact?

Phases of destruction from the Chicxulub impact: Phase I Shockwave & Tsunami; Phase II “Easy-Bake Oven”; Phase III Impact Winter; Phase IV Greenhouse Summer

Changes in dinosaur populations (especially in western North America) before and at K/Pg boundary

Pattern of fates at K/Pg in marine and continental environments

Recovery from the K/Pg extinctions