GEOL 104 Dinosaurs: A Natural History Final Review

Review Tests 1 & 2, especially:

Definition of Dinosauria (the concestor 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. Graviportality: 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, balance, joint motion, 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 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 Small brain size

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?). Air sac breathing with one-way lungs 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 and 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

 $Mesozoic\ marine\ reptiles:\ Ichthyosaurs,\ plesiosaurs,\ hesperornithines,\ sea\ turtles,\ mosasaurs,\ marine\ crocodilians$

Terrestrial life: Plants, insects, amphibians, turtles, tuataras, lizards (incl. snakes), crocodilians (incl. various non-

aquatic types), champsosaurs, pterosaurs

Mesozoic mammals: Origins; diversity; monotremes, multituberculates, therians (eutherians (placentals and

our ancestors) plus metatherians (marsupials plus their ancestors)

Definitions: Extinction Mass extinction

Maastrichtian Campanian Paleogene K/Pg extinction

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

How might each have caused the event?

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

Popular Culture

Changing popular perceptions of Dinosauria

Reconstructing dinosaurs from fossils

Hunting for Dinosaurs

Field techniques to collect fossils Importance of collecting data other than the bones themselves!

In general

What are dinosaurs? What are not dinosaurs?