GEOL 104 Dinosaurs: A Natural History
Final Exam 4 Review

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, digestion, joint motion
Dinosaur Senses and how we reconstruct them: brains, balance (equilibrium), 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 maniraptoans
Evidence for baby dinosaurs in groups
Changes in dinosaur growth (esp. appearance of species-level features in sub-adults)
Ontogenetic niche shift
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
Why did some dinosaurs get so big?
Average Mesozoic dinosaurs considerably larger than largest Cenozoic mammals.
Wacky ideas (gravity changes, Earth's spin, etc.) vs. reasonable ones: parasagittal stance? (necessary but not sufficient), long growth time? (invalidated by discovery of short growth time); increased primary productivity in Mesozoic ecosystems?; co-evolutionary arms race
Why aren't placental mammals as big? Form of reproduction? Less cartilage?

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 ($C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ + 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?

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	Energy required for locomotion	Density of nutrient foramina

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.

Evidence for enhanced metabolic rates in Crurotarsi (and reversal to ectothermy in crocodilians)

Significance of higher oxygen (maybe) and carbon dioxide (definitely) levels, and higher plant productivity, in Mesozoic

<u>Other Organisms of the Mesozoic</u>

Pterosauria: basic adaptations, especially for flight, feeding, & physiology

"Rhamphorhynchoidea" vs Pterodactyloidea. Terrestrial locomotion in the latter.

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 for feeding, locomotion & reproduction) and be able to identify: mesosaurs; ichthyosaurs; placodonts; plesiosaurs; mosasaurs; marine crocodiles; sea turtles; hesperornithines

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

Mesozoic plants: Basic adaptations. Difference between gymnosperm & angiosperm reproduction. Angiosperm origins in Cretaceous; what are the co-evolutionary partners and function of flowers and fruit?

<u>The K/Pg Extinction</u>

Be familiar with the following groups and their 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), crocodilians (incl. various non-aquatic types), champsosaurs, pterosaurs, the various mammals

Definitions: Extinctions Mass extinctions Maastrichtian Campanian "Tertiary" Paleogene K/Pg extinction and various synonyms

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

How might each have caused the event?

What are some of the old models, and why they don't work?

Good evidence for: The Maastrichtian Regression

Deccan Traps volcanism

Chicxulub Impact (iridium layer; shocked quartz; melt glass; tsunami deposits; ejecta deposits; etc.)

What is the environmental impact of each of these agents? The effects and timing of each? What does the magnetostratigraphic record say about the timing of the 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 the K/Pg boundary

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

Vulnerability of dinosaurs due to ontogenetic niche shifts

Recovery from the K/Pg extinctions