GEOL 104 Dinosaurs: A Natural History
Online Exam 4 Review

Dinosaur Paleoecology

Fauna, paleofauna, biogeography, paleobiogeography, cosmopolitan vs. provincial, Laurasia vs. Gondwana
Food webs, energy pyramids
How paleoecology is assessed: methods, evidence
Patterns of dinosaurian history: Late Triassic ("when dinosaurs shared the Earth"); Early Jurassic (diversification); Middle & Late Jurassic ("Golden age"); Early Cretaceous ("rise of the low browsers"); mid-Cretaceous warm peak. Many worlds of the Late Cretaceous: provincialism (distinction between Asiamerica, Europe, Gondwana, etc.)

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