

GEOL 104 Dinosaurs: A Natural History

Final Exam 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. Graviportalty: 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 maniraptorans

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

Estimates of Dinosaur Physiology:

Posture Latitudinal distribution Feeding adaptations (such as dental batteries)
Relation to birds Predator-prey ratio Insulation
Microscopic bone structure (Haversian canals, reworked bone)
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: function for regulating moisture, dumping excess heat, and keeping brains cool
Evidence for enhanced metabolic rates in Pseudosuchia (and reversal to ectothermy in crocodilians)
Significance of higher oxygen (maybe) and carbon dioxide (definitely) levels, and higher plant productivity, in Mesozoic

Paleoart & Molecular Paleontology

Process of creating paleoart

Issues concerning the integument (skin covering) of dinosaurs

Color: how it is produced; what might preserve in the fossil record

Preserved biomolecules

Isotopes: what they are & what they record (trophic relationships; body temperature; migrations; etc.)

Other Organisms of the Mesozoic

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?

The K/Pg Extinction

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

Legacy of the Dinosaurs

History of dinosaurs in popular culture

Dinosaurs as "poster children" for evolution & mass extinction