

GEOL 104 Dinosaurs: A Natural History
Online 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. 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 (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 ($C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O + \text{energy}$; 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?

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 crocodylians)

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