The Significance of the Postcranial Anatomy of the Late Paleozoic Diadectomorph family Limnoscelidae (Tetrapoda, Amniota?)

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The postcranial anatomy of the Late Paleozoic Diadectomorph family Limnoscelidae is significant because the Diadectomorpha are generally considered to be the sister group of the crown group Amniota. In fact, Diadectomorpha's relationship with Amniota is so close that the former have frequently been suggested as amniotes in both crown-based and node-based studies. The Limnoscelidae are probably the most basal family within Diadectomorpha and therefore provide an important frame of reference for studies of diadectomorph and basal amniote interrelationships. For example, the postcranial structure of limnoscelids provides important data bearing on the locomotor capabilities of basal Diadectomorpha. At least six genera have been reported as belonging to Limnoscelidae, though all but *Limnoscelis* are represented by fragmentary materials restricted to the postcranium. The anatomy and phylogenetic validity of the various of limnoscelid genera were reviewed. The survey of the postcranial anatomy of limnoscelids suggests that, with the exception of *Limnoscelis* itself, some, if not most, of the genera assigned to the family Limnoscelidae are not valid taxa. The genus with the most confidently valid morphological basis remains *Limnoscelis*. Thus, *Limnoscelis* provides a significant structural model for the postcranium of taxa near the amphibian to amniote transition.

Evolutionary Novelties in the Feeding Mechanisms of Elasmobranchs

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The evolution of novel feeding behaviors can result from relatively minor changes in anatomy or patterns of muscle activity. Recent research on muscle activity during prey capture in elasmobranchs, particularly that of upper jaw protrusion, is evaluated and the extent to which changes in form and function have resulted in novel feeding mechanisms in sharks and rays is discussed. Motor activity has been documented in four species of elasmobranchs, although they represent the three major groups, *Galea*, *Squalea* and *Batoidea*. These efforts show that while muscles that function in cranial elevation, lower jaw depression and elevation show a conserved pattern of motor activity and function across species, muscles involved in upper jaw protrusion and retraction are functionally plastic and evolutionarily labile. Analysis of elasmobranch upper jaw protrusion mechanisms suggests a mosaic of novel character changes over the course of evolution that involve anatomical changes in all cases and modifications of muscle activation patterns in some cases. In addition, a relatively uncommon behavior of crushing hard-shelled prey in two elasmobranchs has resulted from minor modifications of a basic motor pattern common to other elasmobranchs. Within the evolution of feeding mechanisms of elasmobranchs, there have been several structural changes that retain a conserved motor pattern and behavior. At least one instance of structural modification is accompanied by an alteration in the motor pattern leading to a change in behavior.

Whole Body Mechanics and the Semi-erect Posture: An Inverted-Pendulum Walk in *Alligator*?

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Most studies of locomotor mechanics have focused on species utilizing erect limb postures. In these studies, whole body mechanics are used to evaluate phase relationships of potential energy, total kinetic energy, and total mechanical energy in order to determine if an animal is employing an inverted-pendulum walk. This pattern of locomotion is seen in a variety of mammals, including humans, and two species of reptile. If the sum of positive increments in total kinetic and potential energies are greater than the total mechanical energy during a stride, a percentage of whole-body energy spent to walk is recovered between steps. We evaluated terrestrial locomotion in *Alligator mississippiensis* moving over a force platform array. Our data suggest that while potential and total kinetic energy curves produced by small alligators (mean mass 3 kg) are generally out of phase with one another (indicative of an inverted-pendulum walk), the ability to regain energy may be compromised in these semi-erect reptiles. Supported by NSF-IBN 0080158.

Ecomorphology and the Form-Function Complex

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In his famous 1965 paper together with G. v. Wahlert, W.J. Bock laid the theoretical foundations for ecological morphology. In this paper the terms, form, function, biological role, and adaptation were given precise meaning. Later W.J. Bock clarified many issues concerning the problem of identifying adaptations. However, in his early work much was left open with respect to the interactions of the organism with its environment, and form was understood mainly in qualitative terms. Yet, W.J. Bock did observe the rise of ecomorphology, a term coined by ecologists, with critical eyes and was the first to develop a clear ecomorphological research program (1977, 1990). With W.J. Bock's thoughts on ecomorphology as a framework, I will try to clarify the role of behavior, discuss W.J. Bock's ideas about recognizing and measuring adaptation, and I will also dwell on the problem of predicting function from form, and vice versa. Finally, I will sketch an ecomorphological research program that carries W.J. Bock's ideas further and incorporates recent ideas about behavior, development and phylogenetic methods.

Reconstructing the Evolutionary History of the Nasal Apparatus of Sauropsida, with Special Reference to Archosauria.

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The nasal apparatus of extant Sauropsida (e.g., turtles, squamates, crocodilians, birds) is highly variable, and even greater variability is encountered when extinct taxa are considered. Part of this variability is due to the fact that the apparatus (nasus externus, cavum nasi, sinus paranasales) serves functions beyond simply olfaction and hence has been modified accordingly. Nasal evolution in Archosauria (birds, crocodilians, dinosaurs, etc.) is my major focus, but other sauropsids have also been studied. The anatomy of extinct taxa is addressed within the context of the extant phylogenetic bracket approach for reconstructing unpreserved attributes (using causally associated osteological correlates of soft-tissue structures observed in extant taxa). With regard to nasus externus, the fleshy nostril of probably all amniotes is primitively located rostroventrally within the bony naris, which has important physiological implications, particularly for certain dinosaur clades. The external nose is rarely elaborated in sauropsids (e.g., the narial display organ of gharials). The cavum nasi is relatively simple in most sauropsids, with histologically distinct respiratory and olfactory regions. Conchal structures are variable, and the only homologous concha across Sauropsida is the olfactory concha. Respiratory conchae are present in extant archosaurs, and are physiologically relevant structures in birds and certain other dinosaur clades. Likewise, paranasal air sinuses are consistent features of only archosaurs among sauropsids.

Torque Patterns Occuring During Cyclic Locomotion of Small Mammals on Flat Ground

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Independent of their systematic position, small mammals show rather uniform kinematic patterns during cyclic locomotion. Kinematics and their driving dynamics in terms of physics are linked by gravity, mass distribution (which is rather similar in most small mammals), elasticity and dissipation, about which only little is known in small mammals. Thus we raised the question, whether the kinematic patterns are resembled by comparable uniform dynamic patterns. For this purpose, we performed an inverse dynamic study on four not closely related species: *Galea musteloides* (the cui), *Ochotona rufescens* (the pika), *Rattus norvegicus* (the rat), and *Tupaia glis* (the tree shrew). Ground reaction forces were taken by two special made force plates, kinematics were analyzed using cineradiography (150 frames/