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Titre et résumé de la thèse – Title and abstract of the thesis

Intraspecific and macroevolutionary patterns in the clades Archosauromorpha and Testudinata

Macroevolution describes the divisions of taxonomic hierarchy above the species level, and the formation of complex organ systems. In contrast, intraspecific variation summarizes discrete morphological and physiological differences in one individual or between several individuals of the same species, and can be distinguished between two main types: polymorphism (including sexual dimorphism) and ontogenetic variation. This thesis summarizes my recent work on macroevolutionary and intraspecific patterns in reptiles, focusing on two major clades, turtles (Testudinata) and archosauromorphs.

Applying morphological comparisons, bone histology, cladistics methods, and 2D geometric morphometrics, I investigated, among others, the skull disparity of turtles and archosauromorphs through time, common ontogenetic patterns in the skull of caimanine crocodylians and basal saurischian dinosaurs, ontogenetic growth patterns of crocodylian ancestors, and the evolution of pennaceous (= contour) feathers in theropod dinosaurs.

The major findings of this thesis can be summarized as follows: The cranial disparity of turtles shows a steady increase from the Late Triassic to the end the Late Cretaceous, followed by a period of stagnation, matching global biogeographic events, and indicating a certain resilience across the K/T extinction event. Stem-archosaurs show a previously unappreciated high skull disparity, evolving prior to the major radiation of crown archosaurs. However, disparity patterns in the Ladinian and Carnian indicate a gradual faunal replacement of stem archosaurs by the crown group, followed by an abrupt decline during the Late Triassic. Among others, the major radiation of crown archosaurs benefitted from the evolution of fast growth patterns, which occurred in both pseudosuchians and ornithodirans, and probably correlates with higher metabolic activity levels. During growth, archosaurs show some deeply conserved ontogenetic patterns in the skull, even between species that are strongly separated from each other in morphospace. Finally, while the feather plumage of basal theropod dinosaurs was filamentous, and rather conform within different body regions, the origin of planar pennaceous feathers caused a high plumage diversity in different body regions of theropod dinosaurs, especially in the tail and hindlimbs. This high diversity went hand in hand with the increase of colour patterns, indicating an original biological role of pennaceous feathers in the context of signalling rather than flight.

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Titre et résumé de la leçon d'essai – Title and abstract of the inaugural lecture

Die Kambrische Explosion und der Ursprung der Tierstämme

Der Ursprung des Lebens auf der Erde liegt mindestens 3.5 Mrd. Jahre zurück. Der Ursprung vielzelliger Tiere (Metazoa) fällt gegen das Ende des Präkambriums. Während molekularphylogenetische Analysen den Ursprung der Tiere auf circa 760 Mio. Jahren datieren, finden sich die ersten zweifelsfreien Zeugnisse von tierischen Leben nicht vor 635 Mio. Jahren im Fossilbericht. Die meisten Fossilien dieser sogenannten Ediacara-Fauna lassen sich allerdings keiner heutigen bekannten Tiergruppe zuordnen.

Im Gegensatz dazu sind sämtliche heute bekannten Tierstämme im Kambrium mit einem hohen Artenreichtum fossil überliefert. Dieses plötzliche Auftreten der Tiere wird als kambrische Explosion bezeichnet.

In der angekündigten Probevorlesung soll dieses wichtige evolutionäre Ereignis eingehend vorgestellt sowie deren Ursache und Bedeutung für die Evolution der Tiere erläutert werden.