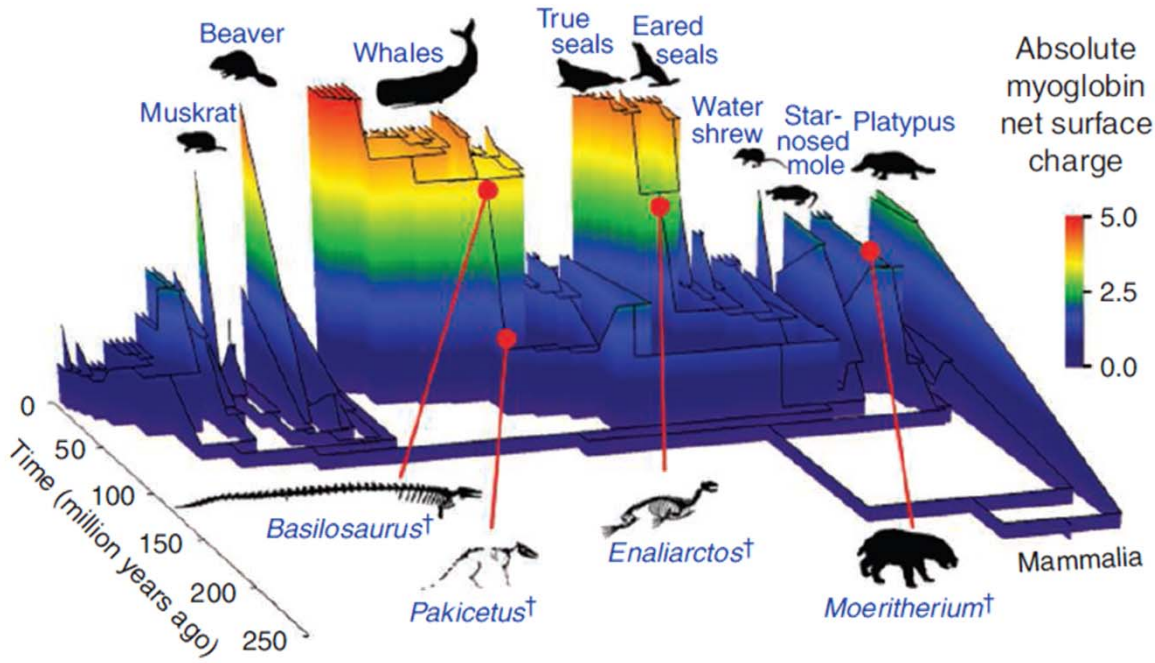
Seminars in Zoophysiology at Aarhus University

Evolution of Mammalian Diving Capacity Traced by Myoglobin Net Surface Charge

Michael Berenbrink
Institute of Integrative Biology,
Liverpool University, UK

I am interested in the diversity of physiological mechanisms that animals employ to survive and strive in different, often extreme environments. The focus of my work is on the respiratory system of vertebrates, particularly the evolution of blood oxygen and carbon dioxide transport mechanisms and globin function. Below a summary of my group's most recent work on the evolution of breath-hold diving capacity in diving mammals



Extended breath-hold endurance enables the exploitation of the aquatic niche by numerous mammalian lineages and is accomplished by elevated body oxygen stores and adaptations that promote their economical use. However, little is known regarding the molecular and evolutionary underpinnings of the high muscle myoglobin concentration phenotype of divers. We used ancestral sequence reconstruction to trace the evolution of this oxygen-storing protein across a 130-species mammalian phylogeny and reveal an adaptive molecular signature of elevated myoglobin net surface charge in diving species that is mechanistically linked with maximal myoglobin concentration. This observation provides insights into the tempo and routes to enhanced dive capacity evolution within the ancestors of each major mammalian aquatic lineage and infers amphibious ancestries of echidnas, moles, hyraxes, and elephants, offering a fresh perspective on the evolution of this iconic respiratory pigment.

Wednesday March 26th at 14h15
at Zoophysiology (1131-127)