Exploring the Evolution and Function of Caudal Fins in Early Vertebrate Locomotion: Insights from Metaspriggina walcotti

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Abstract

The evolution and function of fins in early vertebrates, such as *Metaspriggina walcotti*, remain elusive. *Metaspriggina walcotti*, an early basal vertebrate from the Cambrian period, lacks classical fins yet exhibits proficient swimming capabilities. Investigating the mechanics of its locomotion can offer valuable insights into the evolutionary transition from finless to finned swimming. This study explores the evolution and role of caudal fins in swimming efficiency by comparing *Metaspriggina* to modern fish. Hydrodynamic experiments use abstracted models based on *Metaspriggina walcotti*, employing oscillating thin plates with varying tail fin geometries. By examining the kinematics of early vertebrates lacking distinct caudal fins, we aim to ascertain whether there is an evolutionary convergence towards optimal thrust production in fish caudal fin morphology. By investigating the swimming modes of early vertebrates, our study reveals new perspectives on the locomotion of these ancient organisms and the significance of caudal fins in swimming efficiency. The findings suggest an evolutionary convergence towards optimal thrust production in fish caudal fin morphology, underscoring the functional importance of fins for efficient swimming. Comparative analysis of the locomotion of early vertebrates and modern fish provides a deeper understanding of the evolutionary changes in locomotion strategies and the hydrodynamics of swimming. This research contributes to our broader comprehension of aquatic locomotion and the evolutionary history of fish. It highlights the crucial role of caudal fins in propulsion. It offers valuable insights into the locomotion capabilities of early vertebrates, shedding light on the transition from finless to finned swimming during the Cambrian period.

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