

Evolution and Functional Morphology of Shark Dermal Denticles



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**Venue: Auditorium, 1st Floor,
Interdisciplinary Research Building
跨領域科技研究大樓1樓演講廳**

Host: Dr. Sheng-Feng Shen 沈聖峰研究員

Doctoral Dissertation Defense Presentation

~Attendee must wear mask~

~與會者請配戴口罩~



Abstract

In this Ph.D. study, I examine the morphology and function of dermal denticles, both as single entities and as an interacting armour across sharks. Further, I explore the tempo and mode of denticle disparity on a macroevolutionary scale.

In chapter 2, I use deep learning to objectively quantify denticle disparity and establish ten distinct morphogroups on which all my experiments are based. I further devise a protocol for studying the functional properties of the morphogroups, based on nanoindentation, electron probe micro-analysis, and computational fluid dynamics. The experiments yield functional profiles relating mechanical properties, elemental composition, and swimming performance. I find seven of the ten morphogroups to include ridged denticles, reflecting the evolutionary success of this particular design. Further, I find that classic ridge denticles facilitated a species radiation within the ground sharks (Carcharhiniformes) 166 MYA, but that all ten morphogroups appeared at least 250 MYA.

In chapter 3, I redirect the focus back to the living, interacting sharks. Here, I expand the number of morphogroups from ten to 17 in order to fully appreciate denticle disparity across individual sharks. I apply our understanding of denticle functionality from Chapter 2, and find that each body region is equipped with a set of denticle morphogroups designed to mitigate the physical challenges related to its particular lifestyle. I conclude that denticles of the snout, and fin edge regions exhibit low disparity and relate a “general” function, similar across species. Whereas, denticles from the special, trunk, and fin surface regions display high disparity and express a “special” function linked to lifestyle.

Future endeavours should focus on optimizing sampling strategies to include non-lethal methods, and compile all available data on an online database to facilitate and mitigate conservation management of unknown species involved in the illegal shark finning trade.