SICB Annual Meeting 2022
January 3 - 7, 2022

Results

All times below refer to Phoenix local time.

The following program is preliminary and subject to change, and not all events are listed yet. If you notice a problem, please contact Jake Socha at ProgramOfficer@sicb.org. For those people who are presenting only on SICB+ (virtual only), your presentation will be listed as soon as possible. (SICB+ programming hasn't been completed.)

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Day	Session	Time	#	Author(s)	Title
TBD	SICB+ SICB+		SICB+-	**Schindler, M*; Liu, C; Surapaneni, VA; Tang, T; De Falco, P; Mollen, F; Amini, S; Dean, M; Hanna, S**	Hierarchical Design of Basking Shark Gill Rakers and their potential for High-volume Suspension Filters
Jan 7	S10 S10: Integrating ecology and biomechanics to investigate patterns of phenotypic diversity: Evolution, development, and functional traits	15:30	S10-11	**Surapaneni, V A*; Schindler, M; de Faria, L; Ziege, R; Bidan, C; Mollen, F; Amini, S; Hanna, S; Dean, M**	Groovy and gnarly: Surface wrinkles as a multi-functional motif for terrestrial and marine environments

The Society for Integrative & Comparative Biology

Meeting Abstract

SICB+ - Hierarchical Design of Basking Shark Gill Rakers and their potential for High-volume Suspension Filters *Schindler, M*; Liu, C; Surapaneni, VA; Tang, T; De Falco, P; Mollen, F; Amini, S; Dean, M; Hanna, S; Max Planck Institute of Colloids and Interfaces, Potsdam, Germany; Hohai University, Nanjing, China; Max Planck Institute of Colloids and Interfaces, Potsdam, Germany; Max Planck Institute of Colloids and Interfaces, Potsdam, Germany; University of Westminster, London, United Kingdom; Elasmobranch Research Belgium (ERB), Bonheiden, Belgium; Max Planck Institute of Colloids and Interfaces, Potsdam, Germany; City University of Hong Kong, Hong Kong, China; University College, London, United Kingdom*
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The largest sharks are, like baleen whales, peaceful planktivores filtering water on a massive scale. Even with ram-filtering, basking sharks —the second largest fish— can filter 2000 L per hour, yielding >30 kg of plankton daily, indicating a highly efficient underlying filter structure. The comb-like arrays of gill rakers on the shark's gill arches are believed to be the crucial filter elements, yet this has not been verified due to the logistical challenges of studying this immense fish, and decisive data on raker anatomy are still lacking. We characterized basking shark filter anatomy at multiple size scales, from clinical CT of shark heads down to high-resolution µCT of rakers, combining diverse material techniques (e.g. SEM, spectroscopy, nanoindentation) to link raker morphology and materials with filtering biomechanics. Although the thousands of evenly spaced, thread-like rakers in the oral cavity appear similar to baleen and have been described as keratin, we show them to be modified tooth-like denticles of apatite-reinforced collagen, with a hypermineralized outer enameloid acting jointly with a softer, dentin-like inner layer to allow simultaneous flexibility and wear resistance. Stability and performance of the whole filter array is supported by several features of individual raker threads —e.g. drag-reducing hydrofoil cross sections, elongated sigmoid morphologies, and subtle surface microstructures— which also promote canting of adjacent rakers. These multi-scale tomographic data also enable digital and physical modelling of raker interactions during water influx to render suspension vortices at the raker- and filter-levels. Our data on basking shark raker materials and mechanics will not only help to understand specific links between anatomy and filtering ecology for conservation of this threatened species, but will also explain the biological roots of filter performance, providing bioinspiration for dynamic, high-volume suspension filters.

https://sicb.burkclients.com/meetings/2022/schedule/abstractdetails.php?id=1641