Microscopy TODAY

Coming Events

Due to COVID-19, please check to see if the listed events have been postponed or canceled.

2022

Neuroscience 2022
November 12–16, 2022
San Diego, CA
www.sfn.org/meetings/neuroscience-2022

2022 MRS Fall Meeting
November 27–December 2, 2022
Boston, MA
and
December 6–8, 2022
Virtual
mrs.org/meetings-events/fall-meetings-exhibits/2022-mrs-fall-meeting-exhibit

Cell Bio 2022
December 3–7, 2022
Washington, DC
www.ascb.org/cellbio2022

2023

ICBEM 2023: 17th International Conference on Biomedical Electron Microscopy
March 16–17, 2023
Miami, FL
waset.org/biomedical-electron-microscopy-conference-in-march-2023-in-miami

TMS 2023: 152nd Annual Meeting & Exhibition
March 19–23, 2023
San Diego, CA
tms.org/AnnualMeeting/TMS2023

2023 MRS Spring Meeting & Exhibit
April 10–14, 2023
San Francisco, CA
mrs.org/meetings-events/spring-meetings-exhibits/2023-mrs-spring-meeting

IUMAS-8: 8th Meeting of the International Union of Microbeam Analysis Societies
June 11–16, 2023
Banff, Alberta, Canada
iumas8.wixsite.com/iumas8/events/8th-meeting-of-the-international-union-of-microbeam-analysis-societies

Microscopy & Microanalysis 2023
July 24–28, 2023
Minneapolis, MN
www.microscopy.org/events/future.cfm

2024

Microscopy & Microanalysis 2024
July 28–August 1, 2024
Cleveland, OH
www.microscopy.org/events/future.cfm

Carmichael's Concise Review

Could a Moth's Stealth Technology Make Our World a Little Quieter?

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Bats and moths have been engaged in an acoustic arms race as predator and prey for about 65 million years. During that time bats presumably have improved their echolocation skills, and moths have evolved surfaces that absorb sound energy to evade being located. A group led by Marc Holderied investigated if sound-absorbing surfaces similar to moth wings had noise control applications. The resulting study was first-authored by Thomas Neil [1].

This group and others have shown that freely moving moth wings demonstrate impressive sound absorption properties. The present study was designed to determine if moth wings also function as sound absorbers when backed by an acoustically solid surface, as compared to air.

Scanning electron microscopy (SEM) was used to characterize the morphology of wings of the Chinese tussar moth (*Antheraea pernyi*). The surfaces of the wings were covered with base scales and cover scales that varied in length and width. Scale microstructure comprised parallel longitudinal ridges connected by cross-ribs, which were characterized by "inter-ridge distance" and "cross-rib distance." Finally, "layer thickness" for ventral and dorsal surfaces and base as well as cover scales were measured from wing sections imaged from the side, as a distance from the wing membrane to the tip of the most distal scale.

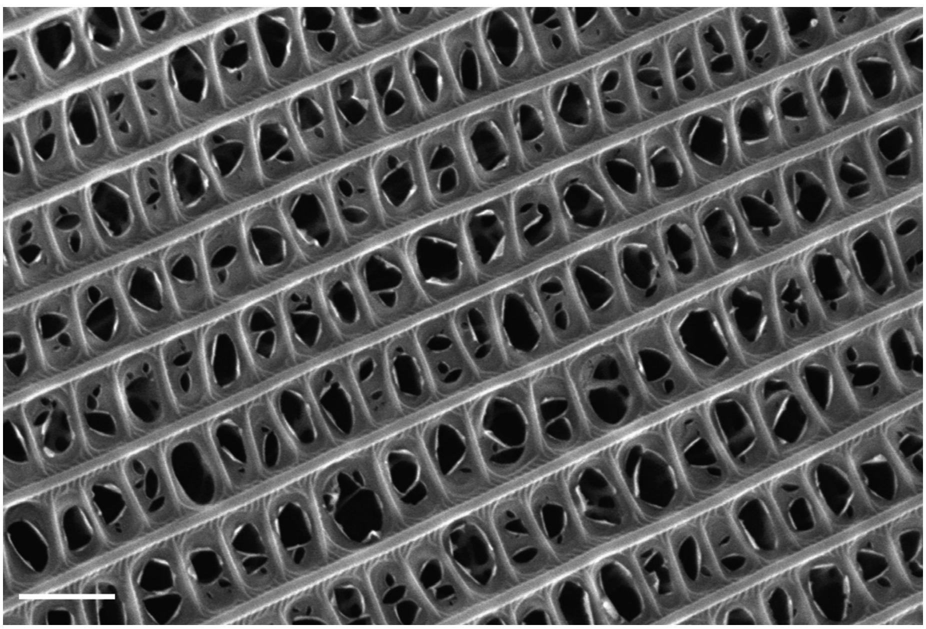

Figure 1: Microstructure of a base scale of *Antheraea pernyi* showing parallel ridges and cross ribs. Scale bar = 2 µm.

doi:10.1017/S1551929522001249

Several measurements were made. These included echo measurements of an aluminum disc, both with and without a wing sample mounted on it. Measurements were made with the dorsal wing surface facing the incident sound and then with the ventral surface facing the sound. The scales were then removed, first from one and then both surfaces, and the same dorsal and ventral measurements were taken. Measurements were also taken with the incident sound moving through an arc 80° either side of perpendicular.

Moth wings were found to be efficient sound absorbers, reducing reflection from an acoustically hard surface by up to 87%. Importantly, this was achieved with a thickness-to-wavelength ratio of only about 1:50. This could mean that sound absorbers can be designed that are much less bulky than what is now achieved in commercial sound absorbers for our homes and offices. Remarkably, after the removal of the scales from the dorsal surface of the wing, the orientation of the incident sound on the surface changed absorptive performance of the wing; absorption remains high when the bald wing membrane faces the sound but almost completely breaks down in the reverse orientation. Neil et al. performed calculations that confirmed the strong influence of the air gap below the wing membrane, but only when it is adorned with scales.

The mechanism of sound absorption is unclear, but is likely a combination of the mechanical absorption of scales of varying size, and therefore varying resonant frequencies, coupled with some dissipation through thermal and viscous effects brought about by the interaction of the scales, wing membrane, and air movement through the scales. Neil et al. hope that this understanding of the absorption mechanisms of scales of the moth wing will inspire the design of the next generation of sound absorbers. It is encouraging that this study might lead to the development of materials that could make our increasingly congested environment a little bit quieter!

References

[1] TR Neil et al., *Proc Royal Soc A* 478 (2022) https://doi.org/10.1098/rspa.2022.0046.

[2] The author gratefully acknowledges Dr. Marc Holderied for reviewing this article.

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