Microscopic vibrational circular dichroism enables supramolecular chirality mapping

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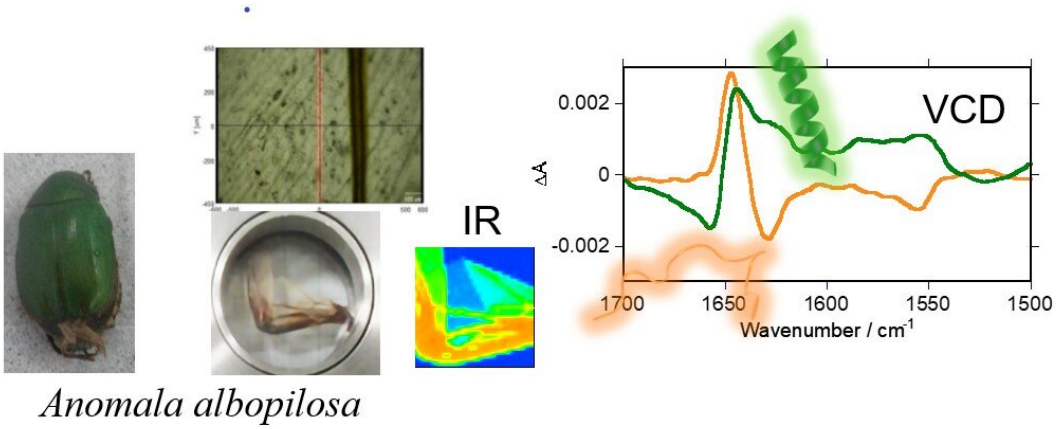

IR intensity mapping and VCD spectra of Anomala albopilosa. Credit: Hisako Sato, Ehime University

Insect wings are interesting and attractive as unique examples of bioinspired and biomimetic materials. They exhibit multi-functional features and provide a natural model for developing a functional device based on organic polymers. Although there are many studies on the structures of insect wings using spectroscopic or morphological methods, only a few focused on their chiral properties.

The present work is unprecedented in that it focused on the supramolecular chiral aspect of a targeted insect hindwing sample. We report the application of a multi-dimensional vibrational circular dichroism system (MultiD-VCD) to the hindwings of an insect (Anomala albopilosa [male]). The MultiD-VCD system with a QCL (quantum cascade laser) was recently developed for the microscopic two-dimensional mapping of VCD signals.

The mapping was performed at the spatial resolution of 100μm on insect hindwing tissue. As a result, it was revealed that the insect hindwing is composed of segregated microdomains consisting of proteins with different secondary structures. The uniqueness of the present method is demonstrated by the following aspects: (i) the observed microscopic distribution of proteins is unattainable by conventional FT-IR spectroscopy; (ii) the identification of a secondary structure of a protein is realized in situ with no pretreatment of the biological sample, such as coating, grinding or solvent extraction.

The work was presented in *The Journal of Physical Chemistry Letters*.

More information: Hisako Sato et al, Mapping of Supramolecular Chirality in Insect Wings by Microscopic Vibrational Circular Dichroism Spectroscopy: Heterogeneity in Protein Distribution, *The Journal of Physical Chemistry Letters* (2021). DOI: 10.1021/acs.jpclett.1c01949

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