Understanding of the velvet worm anti-adhesive skin mechanism as a model for biodegradable and low protein adsorption coatings

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Abstract:

Nature has optimized surfaces with low adhesion to ensure the survival of species during evolution. The velvet worm serves as an excellent example, possessing naturally water-repellent and anti-adhesive skin suited for its habitat in moist environments. Despite living inside rotten trees and under moss, the worm's skin resists adhering to soil or other biological materials. Additionally, the velvet worm secretes a slime that sticks to the cuticles of various insects but not to its own [1].

The velvet worm's cuticle is covered by numerous bristled and non-bristled papillae, with ribbed scales arranged in transverse rows, giving it a velvety appearance and contributing to its water-repellent properties [2, 3]. We studied the velvet worm skin surface using cryo-tomography and analytical techniques such as mass spectrometry, magnetic resonance NMR, and calorimetric techniques. For the first time, we report that the anti-adhesive properties stem from micro and nanostructures formed by crystalline chitin, along with a coating composed of low surface energy molecules like fatty acid amides, atop the nanostructures. This configuration prevents water from penetrating surface cavities, leading to the formation of hydrophobic air pockets that repel hydrophilic substances, including its own slime. Currently, we are working on the bioinspired coating and preliminary results will be presented.

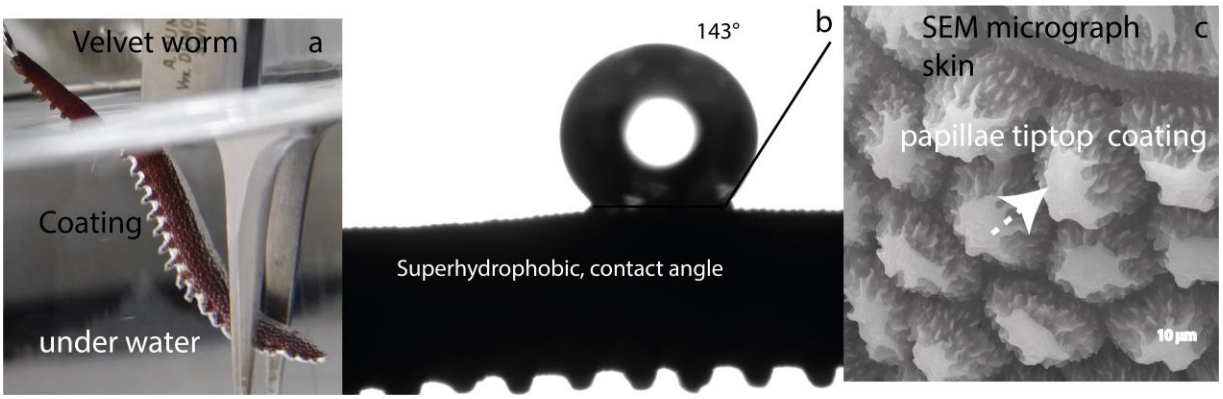

Figure 1: Specimen of velvet worm *Epiperipatus biolleyi* under water. B) water droplet on top of the velvet worm skin. C. SEM image of the skin showing the micro-structured papillae and its tiptop coating.

Biography:

1. Robson, E. The cuticle of Peripatopsis moseleyi. J Cell Sci (1964) s3-105 (71): 281–299.

2. Greven et al. Characterization of chitin in the cuticle of a velvet worm (Onychophora), Turkish Journal of Zoology, 2019.

3. Chandran et al. SEM characterization of anatomical variation in chitin organization in insect and arthropod cuticles, 2016, Micron, 2016.