

Timing of the chitin/chitosan matrix assembly in insects

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Chitin, a polysaccharide composed of N-acetylglucosamine (GlcNAc), and its deacetylated derivative, chitosan (GlcN monomer), are major components of the insect cuticle. Depending on the different parts of the insect's body, a set of constituents including cuticular proteins interact with the chitin and chitosan matrix to form crystalline microfilaments with an amorphous or regular mesostructure, depending on the anatomical position. The overall effects of this system on mechanical and biological properties remain unexplored. In accordance with the preamble provided by CodeXi*, a hypothesis suggests that the ratios between the proportion of chitin and its deacetylated fraction (FA), as well as the pattern (PA) of deacetylation, are strongly correlated and depend on the location of the tissues under study.

First, we studied the allometry of the legs of *Drosophila melanogaster* our model organism in this study and its potential variations, as no previous study had precisely described their organization. We found that the proximal podomeres (coxa and trochanter) and distal podomeres (femur, tibia, tarsus) form distinct allometric groups. We then used fluorescent labelling and confocal microscopy to map chitin deposition at the trochanter, in order to gain an initial understanding of the matrix. By analysing the intensity signals, we observed that chitin deposition is not homogeneous across the structure or throughout the depth of the cuticle layers. This variability likely reflects significant mechanical differences in the function of the trochanter. We ultimately studied the temporal and spatial development of two proteins, Pro-resilin and Cpr56F, at the distal edge of the trochanter cuticle. During metamorphosis, both proteins were expressed at similar stages but at potentially different intensities along the z-axis of the cuticle. Their localization in the x/y-plane is similar but not completely aligned. Hence, chitin matrix assembly involves minute local and timed gene expression and protein allocation control to ensure cuticle function.

*(https://www.dfg.de/foerderung/info_wissenschaft/2022/info_wissenschaft_22_63/index.html)