The secret of softeness, a stiffening truth: an investigation of the molecular and structural properties of the mutable collagenous tissue in a European sea cucumber

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The mutable collagenous tissue (MCT) found in echinoderms, including sea cucumbers, is a unique connective tissue that can rapidly change its mechanical properties in response to certain stimuli. This tissue is constantly switching between different stiffness states! In sea cucumbers, the tissue properties are modulated by the release of molecular factors in the extracellular matrix, leading to the formation of transient cross-bridge between collagens fibrils. Surprisingly, despite this unique ability, there have been few studies on the molecular and structural characteristics of MCT compared to other collagen-based connective tissues.

The present project aims to explore the molecular composition and the structure of the MCT constituting the dermis of the European sea cucumber *Holothuria forskali.* Proteomic analyses coupled to transcriptomics allowed to investigate the specific molecular components of the MCT. Obtained results showed an interesting combination of alpha 1, 2 and 5 chains in purified collagen fibrils. Furthermore, Raman and ATR-FTIR spectroscopy showed bands consistent with type I collagen, which was suggested by SEM observations of the fibrils. Additionally, characterization of the collagen structure and organization in the dermis of *H. forskali* but also of another species, *Cucumaria frondosa,* is being performed using polarized light microscopy, Raman, and X-ray scattering. Preliminary data seem to indicate a species-specific preferential alignment of collagen in holothuroids. Understanding the molecular and structural properties of MCT could have potential applications in the medical and engineering fields as an inspiration for memory-shaped material with reversible viscoelastic state.