

# Collagen morpho-mechanics investigated by correlative microscopy techniques

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The relationship between morphological features and mechanical properties in biological tissues has a particular relevance in various fields, including biology, medicine, pathology, tissue engineering, and regenerative medicine. For the first time we report a correlative study performed by optical microscopy techniques, disclosing the supramolecular collagen morphology correlated with its biomechanical and biochemical properties. In particular, collagen morphology is highlighted by means of SHG microscopy, while its viscoelastic and biochemical properties are determined by simultaneously acquiring both Brillouin and Raman scattered light with a novel correlative approach. The method was evaluated on corneal tissue, demonstrating that a different supramolecular organization of collagen lamellae is responsible of the higher stiffness of sutural lamellae. An optical-biochemical model based on supramolecular symmetry provides the interpretation of the experimental data at the molecular scale.