JOHANNES KEPLER
UNIVERSITÄT LINZ

PHYSIKKOLLOQUIUM
Fachbereich für Physik

Im Rahmen des Physikkolloquiums spricht

Prof. Philipp Thurner

TU Wien, Institute of Lightweight Design and Structural Biomechanics (ILSB)

über

Multiscale collagen mechanics - from organ(oid) to molecule

Abstract:

Biological tissues with passive mechanical function in the human body are generally rich in collagen. Collagens provide both stiffness and toughness. Macroscopically, relationships between tissue-structure, composition and mechanical function have been explored, but comparatively less has been done in this context for the extra-cellular matrix on lower length scales. Nevertheless, smaller scales from sub-mm (i.e. multi-cellular- and cellular-level) to the µm- and nm-scales (i.e. and subcellular-supramolecular- and molecular-level) offer interesting insights. These are the length scales presenting mechanical cues to individual cells or collection of cells.

This talk will cover some relationships of collagen mechanics with composition, chemical modification, hydration and structure. These structure-function relationships will be elucidated with experimental results, obtained at a variety of length scales.

Currently, our investigations on the organoid- cellular- and subcellular- level are focused on disease models and the organoid-level offers itself as a testbed for pharmaceutical agents. In this context, we have been investigating fibrotic diseases of the lung and heart. On the nanometer level, measurements on isolated collagen fibrils are conducted either in the context of specific pathologies, or addressing basic science questions such as the response to loading rate, hydration and viscoelastic properties. Finally, experiments at the molecular level on individual collagen molecules, uncover their high damage tolerance achieved through structural degeneration.

In summary, collagen has superior mechanical properties. How these properties are specified is far from understood, yet highly relevant for many pathologies and regenerative medicine.

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