DIGS-BB SUMMER SCHOOL
Biological Making of Materials 2023

TECHNISCHE UNIVERSITÄT DRESDEN

HANDS-ON SESSION

Structure of the basement membrane in a developing egg chamber

High resolution imaging with atomic force microscopy on the surface of Drosophila egg chambers

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Basement membranes are stiff layers of self-assembled extracellular matrix (ECM) that surround most animal tissues. They exhibit a thickness between ~50-500 nm and tightly adhere to the surfaces of cell sheets by interacting with cellular adhesion receptors and lipids. It is noteworthy that basement membranes reach Young's moduli of up to several Mega-Pascals, while Young's moduli of cells range typically between 100-1000 Pascals. In this way, basement membranes can, in spite of their very thin nature, still exert a strong mechanical influence on cellular epithelial sheets and play a major role in the mechanical stabilization and the shape regulation of tissues. This is for instance illustrated by the recent discovery that circumferential collagen fibers of the basement membrane form a corset around egg chambers of the fruit fly Drosophila melanogaster. This basement membrane corset prohibits radial outgrowth, causing the egg to grow into an elongated ellipsoidal shape over time.

Atomic force microscopy is a technique that allows imaging at much higher resolution than standard optical microscopy which is limited by the wavelength of light. By contrast, using an atomic force microscope, one can obtain molecular resolution of surface topographies by scanning with the tip of a tiny force probe.

In this lab project, we will aim to produce high resolution images of the molecular structure of the outer surface of the fruit fly egg chambers revealing the molecular structure at different developmental stages and during de novo formation after drug-induced removal.

The hands-on tutorial will include:

- Introduction to general AFM handling
- Intro to high resolution imaging
- Probe preparation
- Data analysis