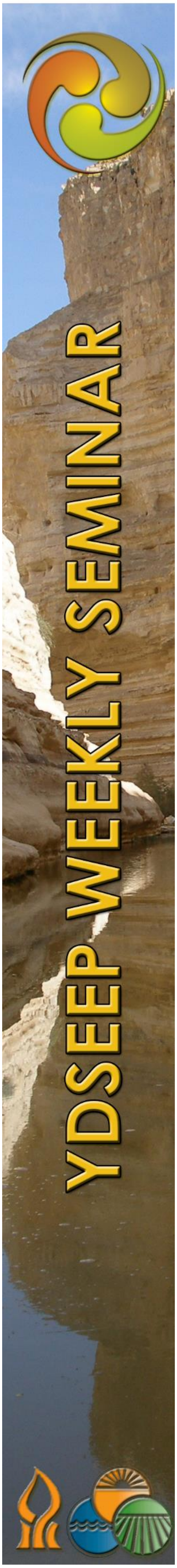

Ben-Gurion University of the Negev
Blaustein Institutes for Desert Research
The Swiss Institute for Dryland Environmental and Energy Research
Alexandre Yersin Department of Solar Energy and Environmental Physics

Ultra-fast contractility dynamics in an ancient epithelium, and the "active cohesion" hypothesis

Shahaf Armon
Stanford, Dept. of Bioengineering, USA

Abstract

All multi-cellular animals need to keep their cells attached and intact, despite internal and external forces. Cellular cohesion in epithelial tissues provides this key feature. In most animals today, cellular contractions in epithelia are associated only with embryogenesis, where slow and precisely controlled contraction patterns are shaping the embryo. In contrast, we study the epithelium mechanics of an ancient, primitive marine animal, *Trichoplax adhaerens*, claimed the "simplest" animal to live today. Composed essentially of two epithelial layers, with no known extra-cellular-matrix and no nerves or muscles, it is still capable of coordinated behavior (e.g. directed locomotion, external digestion, chemotaxis, reproduction by fission). In this animal's epithelium, I report cellular contractions that are orders of magnitude faster than any other epithelium, as known to date. Live imaging reveals emergent contractile patterns that are mostly sporadic and asynchronous, but also include propagating contraction waves across the tissue. In my study I develop a stochastic framework to calculate cellular contraction speeds in the absence of load. Then, I show that the tissue architecture and unique mechanical properties are effectively "softening" the tissue, minimizing the load on a contracting cell, and enabling the speeds we measure. I propose a hypothesis, in which the physiological role of the contraction dynamics is to keep tissue integrity ("active cohesion"). I test this novel concept numerically and predict observed phenomena, e.g. travelling waves. The predictions are yet to be tested in the animal as well as in "higher" epithelia. The mechanism may also be used to engineer "smart" materials that actively resist rupture.

Date & Location:

Tuesday, April 17, 2018, 11:00
Lecture room, Physics Building (ground floor)