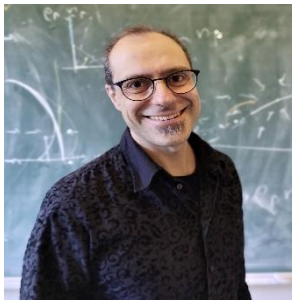
Department of Mechanical Engineering
THE UNIVERSITY OF HONG KONG

SEMINAR

Active dynamics of epithelial tissues



Date: 24 November, 2025 (Monday)
Time: 2:00 p.m.
Venue: Room 7-34 & 7-35, Haking Wong Building
HKU

Speaker: Professor Alexandre Kabla
Department of Engineering
University of Cambridge
UK

Abstract:
Epithelial tissues play a crucial role during embryonic development and in adult organisms, forming essential physiological barriers within the body. These tissues frequently undergo and even instigate significant deformations while maintaining mechanical integrity. This presentation examines the autonomous force-generating behaviours of epithelial tissues and their mechanical consequences, emphasizing theoretical and computational modelling strategies. Experimental investigations of in vitro MDCK cell monolayers reveal spontaneous contractility that generates tissue-scale tension and induces curling at free edges, behaviours absent in isolated cells but emergent at the collective level. Epithelial tissues also continuously remodel through cell neighbour exchanges, particularly during embryonic morphogenesis when coordinated cell rearrangements drive large-scale tissue flows. The interplay between active force generation and passive mechanical response determines the rate and spatial organization of these processes. Through modelling, we investigate how individual cell rheology, active contractility, and mechanical coupling give rise to tissue-scale behaviours. Our findings reveal that mechanical coupling amplifies both internal and external mechanical signals, creating sensitivity to stress states and boundary conditions that cannot be predicted from single-cell properties alone.

Biography:
Professor Alexandre Kabla brings together computational, mathematical and mechanical frameworks to understanding how subcellular processes generate coordinated biological behaviours at tissue and organism scales. His academic journey, from foundational studies in foam physics and granular matter at the College de France through postdoctoral positions at leading institutions (Australian National University and Harvard University), equipped him with the theoretical and experimental tools to bridge disparate disciplines. Since establishing his research group at Cambridge in 2007, he has developed a coherent vision of mechanobiology centred on a fundamental question: how do mechanical forces and physical constraints orchestrate large-scale biological phenomena including embryo development, cancer metastasis, and wound healing? Rather than treating mechanics and cell biology as separate domains, he demonstrates how geometrical constraints induce emergent modes of collective cell migration, how strain drives fibre alignment in tissue networks, and how mechanical interactions coordinate cell movement.

His work on collagen gels, tissue kinematics and viscoelastic models exemplifies this integration, establishing quantitative frameworks that reveal the physical principles underlying tissue behaviour and revealing how cells actively manage stress dissipation and mechanical adaptation. Ultimately, Kabla's academic vision articulates a simple proposition: that understanding biological systems requires recognizing them as physical systems governed by mechanics and material properties. This perspective has opened new avenues for comprehending development, disease, and tissue engineering through the lens of physics and engineering rather than biology alone.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Y. Lin (ylin@hku.hk) and Prof. X.F. Li (lixf@hku.hk).