MATH-IMS Joint Applied Mathematics Colloquium Series
The Chinese University of Hong Kong

This MATH-IMS Joint Colloquium Series is organized by Center for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics and Institute of Mathematical Sciences (IMS) at The Chinese University of Hong Kong. The colloquium series focuses on mathematics and applications of artificial intelligence, big data and related topics.

Date: June 4, 2021 (Friday)
Time: 16:00-17:00 (Hong Kong Time)
Zoom Link: https://cuhk.zoom.us/j/92775210812

Mathematical Models of living tissues and the Hele-Shaw limit
Speaker: Professor Benoît Perthame
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Abstract: Tissue growth, as it occurs during solid tumors, can be described at a number of different scales from the cell to the organ. For a large number of cells, 'fluid mechanical' approaches have been advocated in mathematics, mechanics or biophysics. Since the 70's the mathematical modeling has been progressing regularly, posing new mathematical questions. We will focus on the links between two types of mathematical models. The 'compressible' description describes the cell population density using systems of porous medium type equations with reaction terms. A more macroscopic 'incompressible' description is based on a free boundary problem close to the classical Hele-Shaw equation. In the stiff pressure limit, one can derive a weak formulation of the corresponding Hele-Shaw free boundary problem and one can make the connection with its geometric form. The mathematical tool to perform the incompressible limit is the Aronson-Benilan estimate and we will show why a L^2 version is needed. We will also show that a L^4 estimate on the pressure gradient can be derived.

Bio: Benoît Perthame is a professor at Sorbonne Université and member of the French Academy of Sciences. He has served as head of Laboratory Jacques-Louis Lions since 2013, and head of division of mathematics at European Academy of Science since 2015. Prof. Perthame got his PhD in mathematics, supervised by Prof. Pierre-Louis Lions at University Paris IX Dauphine in 1983. Prof. Perthame is a famous applied mathematician. His research interests include mathematical modeling of chemotaxis and movement and self-organization of cells and bacteria, neural networks, tumor growth and chemotherapy, population growth and evolution. Prof. Perthame has published more than 100 papers in leading journals and supervised many students who have achieved permanent academic positions. Prof. Perthame has received numerous honours and awards, including the Blaise Pascal Medal of European Academy of Sciences and the Inria Prize. He was an invited speaker at the International Congress of Mathematicians in Zürich (1994), plenary speaker in Seoul (2014) and invited speaker at ICIAM 2015. He is also running the ERC Advanced Grant Adora.