THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

SEMINAR

How Life Got Moving: The Biophysics of The Bacterial Flagellar Motor

by

Professor Matthew BAKER
School of Biotechnology and Biomolecular Sciences
UNSW Sydney, Australia

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Place: Rm 311, Science Centre North Block, CUHK

ALL INTERESTED ARE WELCOME
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Abstract

The bacterial flagellar motor (BFM) is a fascinating molecular complex and the canonical rotary nanomachine. This motor has taught us a lot about how biology makes use of physics to utilise nanomachines close to the thermal limit. Alongside the advent of optical tweezers, the BFM has been used to apply and measure picoNewton forces across nanometres to understand the relationship between torque and speed and how the conversion of ion flow into mechanical work has been optimised over billions of years.

The BFM is ~40 nm in diameter, capable of rotating at 1000 Hz, self-assembles in the membrane and changes rotational direction in milliseconds. This rotation is powered by the stator complex, with recent structures hinting that these are themselves an even tinier rotating nanomachine. Matt's foray into biophysics started with measuring fluctuations of simple beads in optical traps, and then when he first got to take bacteria out of the freezer and put them back at the end of the day, he fell in love with microbiology. He now combines statistical phylogenetics with structural and sequence homology to design and test engineered proteins to power motility [1]. Overall, we want to understand the origin of torque generation by looking at protein histories [2] and surveying all known flagellar motors to map the gain and loss of motility across the tree of life [3].

References:
[1] Ridone, P. and Baker, M.A.B. Journal of Bacteriology (2025)
[2] Puente-Lelievre, … Baker, Matzke, mBio (2025)
[3]Philip, … Baker, ISME Journal (2025)

Enquiries: 3943 6303