

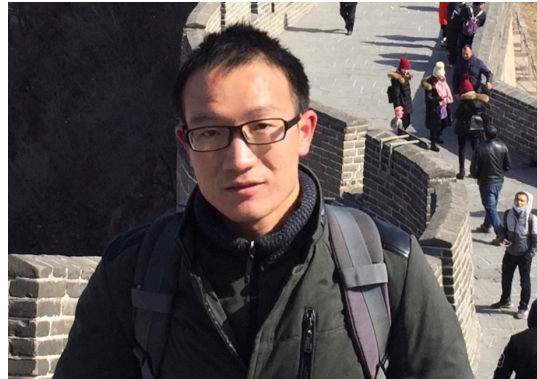


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Department of Medicine
Channing Division of Network Medicine

Channing Network Science Seminar

July 12 (Friday), 2019, 11am @ 5th-floor conference room



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Emergence of collective oscillations in adaptive cells

Abstract: Collective oscillation of cells in a population has been reported under diverse biological contexts and with vastly different molecular constructs. Could there be common principles similar to those that govern spontaneous oscillation in mechanical or electrical systems? Here, we answer this question in the affirmative by categorising the response of individual cells against a time-varying signal. A positive signal relay through collective cell action is required to sustain the oscillations, together with phase matching. The two conditions yield quantitative predictions for the onset cell density and frequency in terms of measured single-cell and signal response functions. Through mathematical constructions, we show that cells that adapt to a constant stimulus generally satisfy the phase-matching requirement. Thermodynamically, adaptation opens an active" frequency window for stimulated energy flow from cells to the signal. Analysis of dynamical quorum sensing in several cellular systems with increasing biological complexity reaffirms the pivotal role of adaptation in powering oscillations in an otherwise dissipative cell-to-cell communication channel. The physical conditions identified can be used to design synthetic oscillatory systems.

Bio: I grew up in China, and obtained both my B.S. and Ph.D. in Tsinghua University, majoring in Physics. Supervised by Prof. Leihan Tang, I obtained a solid training in statistical physics, working broadly on non-equilibrium statistical physics and its application to sub cellular processes as well as to collective cellular dynamics. Prior to completion of my Ph.D., I spent half a year in Princeton with Ned Wingreen on protein evolution. In the fall of 2018, I started my Postdoc in Allon Klein's lab in Harvard Medical School, interested in using lineage tracing to address important development questions.

Hosted by Yang-Yu Liu