PHYSICAL MATH SEMINAR

Statistical physics of embryonic transcriptomes reveal map of cellular interactions

DOMINIC SKINNER
Northwestern University

ABSTRACT:

Starting from one totipotent cell, complex organisms form through a series of differentiation events, resulting in a multitude of cell types. Conceptualizing this process as a single cell travelling down Waddington's landscape neglects the interconnected nature of development; cells must coordinate within an embryo and differentiate in a spatially robust manner. Using recent single-cell sequencing data of early ascidian embryos, we leverage natural variation together with techniques from statistical physics to investigate development at the level of complete interconnected embryo. After robustly identifying distinct transcriptomic states or cell types, a statistical analysis reveals correlations within embryos and across cell types beyond mean expression levels. From these intra-embryo correlations, we infer minimal networks of cell-cell interactions using regularization and the principle of maximum entropy, revealing spatial connections that are of key importance in development.

TUESDAY, October 10, 2023
2:30 PM – 3:30 PM
Building 2, Room 449

https://math.mit.edu/pms/

Massachusetts Institute of Technology