Introduction to Biological Physics 生物物理導論

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Credit: 2

Schedule: Mondays, 10:20-12:10

Venue: R815, Department of Physics, NTU

This course introduces the physical principles that govern living systems, following the framework of Phil Nelson's Biological Physics: Energy, Information, Life and Rob Phillips's Physical Biology of the Cell The course emphasizes quantitative reasoning and demonstrates how simple physical principles can explain some phenomena in living systems at the molecular, cellular or tissue levels.

Students will learn how concepts from thermodynamics and statistical physics provide a unified language for understanding biological processes. Topics include the diffusion and random walks, molecular binding, molecular motors, force generation by the cytoskeleton, cell and tissue mechanics. Throughout the course, quantitative models are integrated with experimental observations to illustrate how physicists formulate predictive theories for living systems.

The course emphasizes estimation, order-of-magnitude reasoning, mathematical modeling, and the interpretation of experimental data.

Prerequisites: Calculus

Schedule

Week	Topic
1	Introduction to biological physics
2	Central Dogma
3	Biology by the number
4	Diffusion and random walks (I)
5	Diffusion and random walks (II)
6	Life at low Reynolds number
7	Mid-term report
8	Entropy rules
9	Gibbs and Boltzmann distribution
10	Ligand binding
11	Cooperativity
12	Reaction-Diffusion and gene regulation
13	Cytoskeleton and cell migration
14	Single molecule biophysics
15	Final report (I)
16	Final report (II)