PHYSICAL MATHEMATICS SEMINAR

Optimizing transport in the vein network of Physarum polycephalum

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ABSTRACT:

Individuals can only function as integrated organisms when information and resources are shared across a body. Signals and substrates are commonly moved using fluids, often channeled through a network of tubes. Peristalsis is one mechanism for fluid transport, which is caused by a wave of cross-sectional contractions along a tube. We extend the concept of peristalsis from the canonical case of one tube to a random network. Transport is maximized within the network when the wavelength of the peristaltic wave is of the order of the size of the network. The slime mold Physarum polycephalum grows as a random network of tubes, and our experiments confirm peristalsis is used by the slime mold to drive internal cytoplasmic flows. Comparisons of theoretically generated contraction patterns with the patterns exhibited by individuals of P. polycephalum demonstrate that individuals maximize internal flows by adapting patterns of contraction to size, thus, optimizing transport throughout an organism. This control of fluid flow may be the key to coordinating growth and behavior, including the dynamic changes in network architecture seen over time in an individual.

TUESDAY, SEPTEMBER 24, 2013
2:30 PM
Building E51, Room 149

Reception following in Building E17, Room 401A
(Math Dept. Common Room)

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