April 2012

MADALGO seminars by Kurt Mehlhorn, Max-Planck-Institut für Informatik

Physarum Computations

Abstract:
Physarum is a slime mold. It was observed over the past 10 years that the mold is able to solve shortest path problems and to construct good Steiner networks (Nakagaki, Yamada, Toth, Tero, and Takagi). In a nutshell, the shortest path experiment is as follows: A maze is built and the mold is made to cover the entire maze. Food is then provided at two positions *s* and *t* and the evolution of the slime is observed. Over time, the slime retracts to the shortest *s*-*t*-path.

A mathematical model of the slime's dynamic behavior was proposed in 2007 by Tero, Kobayashi, and Nakagaki. Extensive computer simulations of the mathematical model confirm the experimental findings. For the edges on the shortest path, the diameter converges to one, and for the edges off the shortest path, the diameter converges to zero.

We review the wet-lab and the computer experiments and provide a proof for these experimental findings.

A video showing the wet-lab experiment can be found at
http://www.youtube.com/watch?v=tLO2n3YMcXw&t=4m43s