Module 6: Dictyostelium cluster formation & slug movement

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Aim

- this was planned as a one week project, students should develop a complex model
- teach them about biology: morphogenesis, cellular behavior, ...
- teach them about mathematics: CPM, PDE, coupling

Description

- good description on what has been done can be found in the report by the students (see section Papers)
- it's been two days of teaching:
  - first explain CPM and let them play with that a little (e.g. cell sorting)
  - explain PDE system we are going to use
    - I had to explain about phase plane analysis quiet a bit
- then on day 3 start to couple PDE & CPM
  - start with coupling in one direction only
    - e.g. first give a fixed gradient and let CPM cells perform chemotaxis
    - then formulate a PDE where a substance is only produced where CPM cells are
  - then couple in both directions (implement the Savill model)
    - perform clustering and slug movement experiment

Paper

- Savill, N. J., & Hogeweg, P. (1997). Modelling morphogenesis: from single cells to crawling slugs. J. Theor. Biol, 184, 229-235. link
- Stan Marée (2002), From pattern formation to morphogenesis: multicellular coordination in *Dictyostelium discoideum* link
- Alberto Quintero, Mirko Myllykoski, Anna Igolkina, Alexandra Rohde O'Sullivan Freltoft, Nitya Dixit, Fabian Rost (2012), Morphogenesis and Dynamics of Multicellular Systems, link

Morpheus models

clusters_new_parameters.mp4

h CrawlingSlug.xml |h

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