

Module 6: Dictyostelium cluster formation & slug movement

Author: Fabian Rost

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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```

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From: <https://imc.zih.tu-dresden.de/wiki/morpheus/> - **Morpheus**

Permanent link: <https://imc.zih.tu-dresden.de/wiki/morpheus/doku.php?id=documentation:course:module6&rev=1357902981>

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