Morpheus

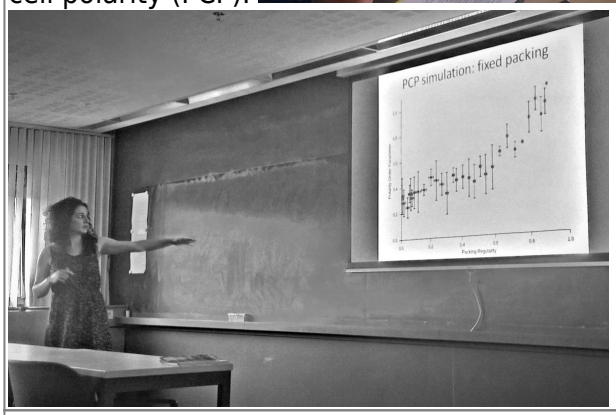
Morpheus is a modeling and simulation environment for the study of multiscale and multicellular systems.

Morpheus is being developed by Jörn Starruß and Walter de Back at the IMC group headed by prof. Andreas Deutsch. We are part of the Center for High Performance Computing and the Institute for Medical Informatics and Biometry at the TU Dresden, Germany.

Morpheus on Mac OSX 10.13 High Sierra October 2017
Mac users who upgraded to Mac OSX 10.13 High Sierra may experience problems opening Morpheus. A temporary workaround can be found here.
New release: Morpheus 2.0 RC2 September 2017
We are proud to announce the feature complete release candidate of the coming Morpheus 2.0. From September 28th on everyone is invited to test the binary packages while we keep updating the documentation for the final release.
Morpheus Workshop at Multiscale Biology Summer school, Nottingham September 2017
We are excited to present Morpheus in a practical session at the Multiscale Biology Summer school organized by prof. Markus Owen from the UK Multi-scale biology networks. Our session will take place on 13 September 14:30 - 17:30. **Participants: please find the materials for the workshop in this GitLab repo**.
Updated the Windows binaries June 2017
After we were made aware that the binary package for MS Windows were outdated, we have now built and uploaded the Windows packages. They now reflect the current master branch. Please find the new version on the download page.
Talk and workshop at Institute for Computational Biology in Munich May 2017
On Tuesday May 30, 2017, Walter de Back will present Morpheus at the Institute for Computational Biology, Helmholtz Zentrum München, hosted by Jan Hasenauer. After the lecture, there will be room for a hands-on session. If you want to join this session, please download and install Morpheus in advance.
Workshop at Helmholtz Centre for Infection Research in Braunschweig May 2017
As part of a graduate school workshop on Systems Biology at the HZI in Braunschweig, we gave a one-day workshop on multi-scale modeling of multicellular systems. Some 15 PhD students and postdocs with various backgrounds were introduced to Morpheus with a lecture, tutorial and a hands-on session.
Summer school on Math Biol of Tissue Mechanics in Leiden June 2016

Morpheus on Mac OSX 10.13 High Sierra October 2017

At the ESMTB/EMS summer school on tissue mechanics, 40 young researchers from all over the world gathered at the Lorentz center in Leiden, the Netherlands, for a hands-on workshop mathematical approaches to analyze and model the biomechanics of tissues and the collective behavior of cells. Our team used Morpheus to investigate the effects of feedback between tissue packing and planar cell polarity (PCP).



Morpheus in Current Opinion in Biotechnology review May 2016

A recent review in Current Opinion in Biotechnology on multi-class and multi-scale models of complex biological phenomena mentions Morpheus: "*...software tools, most recently Morpheus and Smoldyn [...], have been developed to allow a broader audience to access this framework.* ". See the publication page or read the paper.

Beta version of Morpheus 2.0 released March 2016

We are proud to announce the release of a *beta version* of the new Morpheus 2.0! This release provides a wide range of new features to make modeling more flexible and the graphical interface more intuitive. Importantly, it is released under an *open source license* on our new GitLab repository. This provides transparency and extensibility by allowing users to develop their customized plugins. We are aiming to create a *community of developers* around Morpheus 2.0 and are looking forward to your contributions! Curious? Have a look at the "what's new" page, download the binary package, or check out the source repository.

Please note that this is a beta release: it is feature-complete but can contain bugs and is not advised for production work.

Morpheus Courses and Workshops November 2015

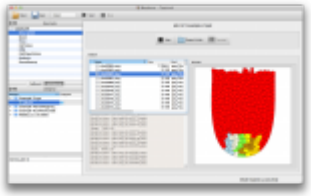
Lots of Morpheus events this month! Besides the thesis defense by Walter de Back, we did a workshop for IMB, TU Dresden and ICB, Helmholtz München, a course on tissue patterning for the Dresden Graduate School for Biomedicine and Bioengineering (DIGS-BB) and a workshop for the SysBio group at UNLP in Argentina (see the pictures). And there is more to come. Contact us if you are interested in joining or organizing a workshop.

Open source release coming soon! April 2015

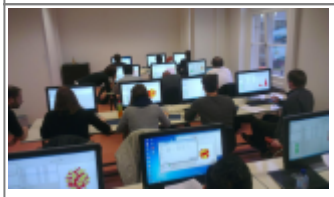
Morpheus on Mac OSX 10.13 High Sierra October 2017

We are currently preparing a major new release of Morpheus, version 2.0! This release adds transparency, customizability and extensibility. The source code will be distributed under open source license. Morpheus 2 includes a stable API to enable plugin development. We redesigned MorpheusML to improve modeling flexibility and its consistency with formats such as SBML. We further improved the in-code and in-app documentation. We can't wait to release and share the code with you.
Check out the new features.

Morpheus version 1.2 released! Nov 2014


We are happy to announce the release of a brand new version of Morpheus! Version 1.2 improves modeling flexibility, automatic scheduling and computational efficiency. It features a new preview panel and we added three new example models showing new features.
Check out what is new or download Morpheus 1.2 directly.

Workshop on Computational Stem Cell Biology Oct 2014


The German Stem Cell Network organized a workshop on Computational Stem Cell Biology in Dresden, 1-2 December 2014. Morpheus was used in a hands-on session to construct multicellular and multiscale models. More info

Morpheus User Forum Jul 2014

We have opened a new forum for questions from users. Please use this forum for modeling issues, implementation questions, bug reports and feature requests. To post a question, visit the Morpheus user forum or mail it to: morpheus-users@googlegroups.com

Previous announcements

Modeling multicellular systems

Morpheus implements algorithms and solvers for the simulation and integration of cell-based (Potts) models, reaction-diffusion systems and models of ordinary differential equations. Due to its modular design, it allows a range of auxiliary spatiotemporal models to be constructed.

Check out the example models for an overview of modeling possibilities. For details, see the user manual.

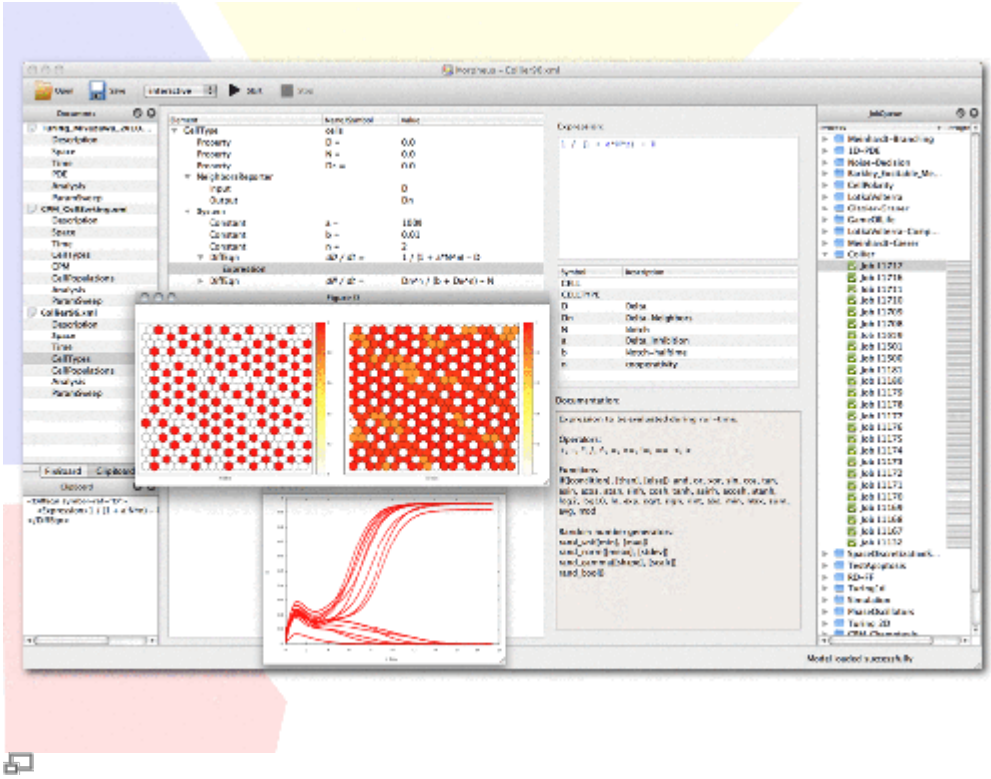
Modeling without programming

Morpheus uses a model description language based on biological and mathematical terminology to translate model descriptions into numerical simulations. This domain-specific language allows the construction of complex multiscale models without programming or scripting.

It enables the straight-forward specification of mathematical models, such as systems of differential equations, in conventional in-fix notation, parsed by muparser.

Automated model integration

Integration of models representing processes at multiple spatiotemporal scales is, to a large extent, automated in Morpheus. Based on the inter-dependencies between (sub)models as specified in mathematical expressions, the simulator automatically maps spatial data and schedules of numerical updates such that ensure validity and optimize computational performance.



Morpheus user interface (click for a tour).

Graphical user interface

The stand-alone graphical user interface provides a number of workflow tools. Its features include:

- A model editor to create and edit models
- Job control to execute multithreaded and parallel simulations
- A result archive to browse simulation results and restore models
- Batch processing for parameter exploration and sensitivity analysis
- Execution of simulations on remote high performance computers

Publications

Check out the list of publications for papers on Morpheus or its application in research and education.

Μορφευς is the Greek god of dreams. The name signifies the fashioner or moulder, because he shaped or formed the dreams which appeared to the sleeper. (Ovid's Metamorphoses xi. 635., Smith, 1873).

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