



# Parameter estimation for biomedical whole-tissue simulations in open source software Morpheus

Modern biomedical research increasingly employs whole-tissue simulations to study hypotheses on disease progression and to explore potential therapies. This emerging field of Systems Medicine depends on powerful simulation software and tools for data analysis and parameter estimation. The open source software Morpheus (1,2,3), developed at TU Dresden, is the first such whole-tissue simulator that consequently supports declarative modeling, i.e. it is co-developed with a novel model description language MorpheusML (4) to separate model from implementation and therewith enables iterative model extension and estimation of biologically founded model parameters like cell division rate or migration speed. The next big thing will be a user-friendly parameter estimation tool for Morpheus, the development of which is funded by BMBF.

## More information:

(1) Starruß, de Back, Bruschi, Deutsch. Morpheus: a user-friendly modeling environment for multiscale and multicellular systems biology. *Bioinformatics* 30, 1331, 2014.

(2) Homepage incl. references to biomedical applications: <https://morpheus.gitlab.io>

(3) Open source code: <https://gitlab.com/morpheus.lab/morpheus>

(4) MorpheusML model repository: <https://imc.zih.tu-dresden.de/wiki/morpheus/doku.php?id=examples:examples>

**Language:** German or English

**Suitable for:** Diplomarbeit / Master Thesis

## Aufgaben der Arbeit:

- 1) Analysis of parameter estimation workflow, data throughput, simulation efficiency
- 2) Evaluation of different summary statistics for comparing model to experiment
- 3) Design of an interface between the simulation engine and the parameter estimation wrapper
- 4) Implementation of a prototype
- 5) Validation and evaluation of the prototype using experimental data from organ regeneration

## Voraussetzungen:

- Kenntnisse in C/C++
- Erfahrungen im Umgang mit Python

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