Image-based Systems Biology

Image aquisition

Experimental study

Image prepro-cessing

New experimental settings

Predicted Behavior

ROI seg-mentation

IBM

Imaging

Image-based Systems Biology

Modeling and Simulation
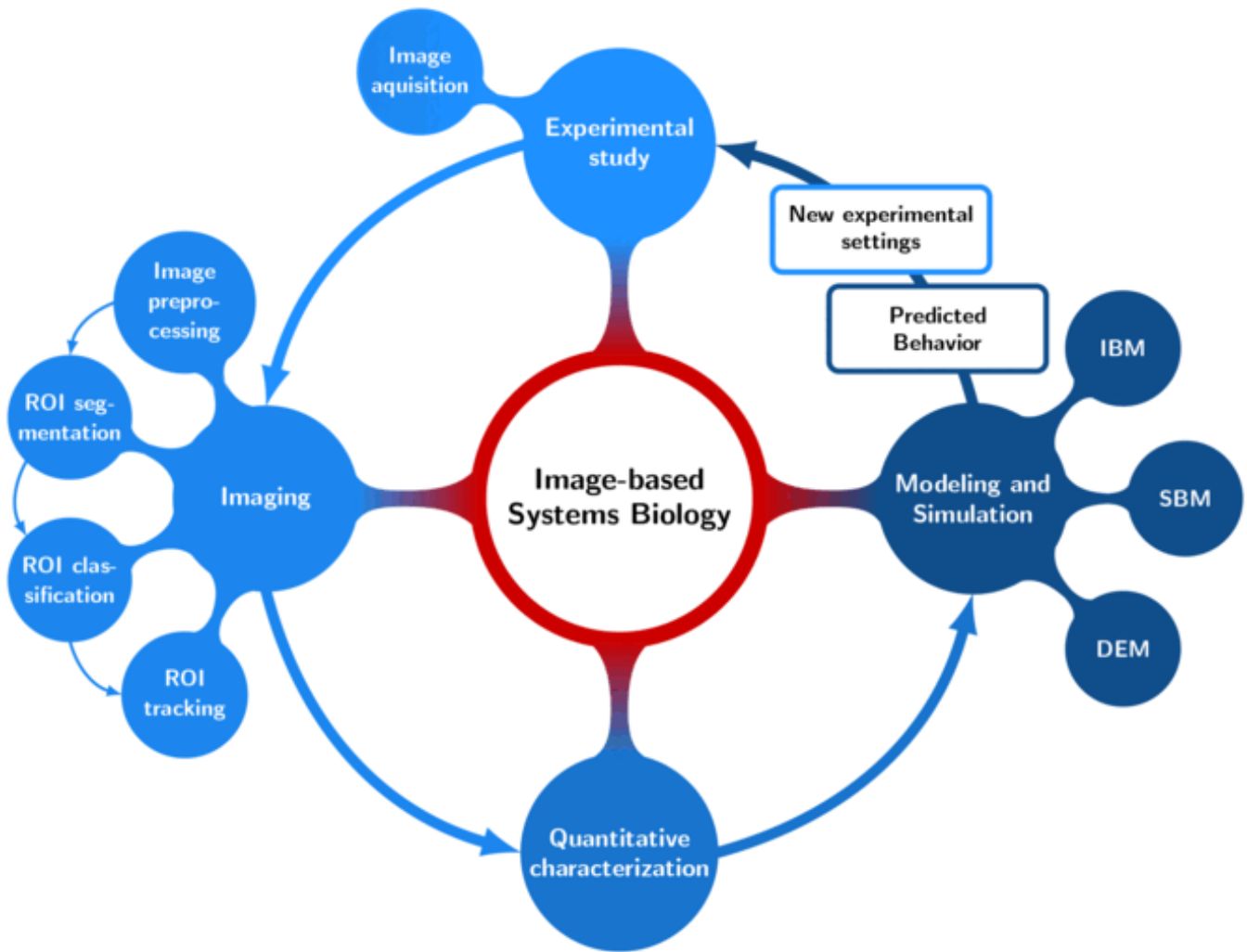
SBM

ROI clas-sification

ROI tracking

DEM

Quantitative characterization

The research group Applied Systems Biology is concerned with the mathematical modeling and computer simulation of infection processes by human-pathogenic fungi. The spatio-temporal data basis for these models is acquired from the automated analysis of microscopy images on infection processes for high-throughput screening. This modern approach is termed Image-based Systems Biology and allows modeling morphological, functional and dynamical aspects of host-pathogen interactions. It can be applied both in the context of infection biology research and in the context of natural product research.

In many cases, microscopic image data, which are nowadays routinely generated, are only used for qualitative illustrations of some biological process under consideration. In contrast, Image-based Systems Biology seeks to take full advantage of the information contained in images and includes the following steps:

1. Acquisition and automated analysis of image data for high-content and high-throughput screening,
2. Quantitative description of biological processes by appropriate characteristic measures,
3. Construction of image-derived spatio-temporal models and predictive computer simulations.

Image-based Systems Biology establishes an essential connective link between experimental and theoretical examination of biological processes at a quantitative level. For example, virtual infection models based on image data allow for systematic analyses where the complexity of the parameter space is narrowed down by identifying causal relationships between manipulated parameters and observable effects. Not only is this resource friendly and rapid but it is also ethically appealing in that the number of *in vivo* experiments can be significantly decreased by predicting which parameters should be investigated for conclusive research.