## Quantitative virtual infection modeling of sepsis

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#### **Predictions and new hypothesis**

- Using the mathematical model, new *in silico* experiments can be done
- Produce useful predictions or extrapolations that match experimental results or suggest new experiments
- Permit data to be generated that is beyond present-day experimental capabilities



Systems Biology

Predictions based on computer simulations

Quantitative mathematical modeling

### **Situation-dependent** mathematical modeling

- Choice of appropriate modeling approach depends on the underlying data and the hypothesis to be tested
- Components of the model are described by parameters which define the dynamics and morphology of the components

### **Quantitative characterization of processes**

- Yield non-intuitive insights into how a system or process works
- Identify missing processes or components in a system
- Understand and visualize complex processes

# resolution of individual

state-based model (SBM)

objects

agent-based model (ABM)

dysregulated immune systems with decreasing number of immune cells [2], e.g. neutropenia

Virtual patient

Quantification and

extrapolation of the

immune response in

- With increasing resolution of space and individual objects the computational costs are increasing
- Parameters are estimated by fitting experimental data to the model

ordinary	partial
differential	differential
equations	equations
(ODE)	(PDE)

space resolution

### **Bottom-up approach**

- models [2]
- at a higher level





### Virtual infection model

- Adding spatial information (morphology and migration)

agent-based model	

#### **References:**

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