

Image-based Systems Biology of Infection.

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Abstract

The successful treatment of infectious diseases requires interdisciplinary studies of all aspects of infection processes. The overarching combination of experimental research and theoretical analysis in a systems biology approach can unravel mechanisms of complex interactions between pathogens and the human immune system. Taking into account spatial information is especially important in the context of infection, since the migratory behavior and spatial interactions of cells are often decisive for the outcome of the immune response. Spatial information is provided by image and video data that are acquired in microscopy experiments and that are at the heart of an image-based systems biology approach. This review demonstrates how image-based systems biology improves our understanding of infection processes. We discuss the three main steps of this approach—imaging, quantitative characterization, and modeling—and consider the application of these steps in the context of studying infection processes. After summarizing the most relevant microscopy and image analysis approaches, we discuss ways to quantify infection processes, and address a number of modeling techniques that exploit image-derived data to simulate host-pathogen interactions *in silico*.

Involved units

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