Ruman Gerst

From single-cell to whole-organ monitoring: Morphokinetic characterisation of infection via quantitative image analysis

Infectious diseases affect the function and morphology of single cells, as well as of whole organs. The wide range of spatial dimensions require the application of various imaging techniques, e.g. laser-scanning fluorescence microscopy (LSM) to study the single-cell level, and lightsheet microscopy (LiSM) to characterise the whole-organ level. An objective characterization of the infection processes demands the development of new mathematical algorithms that are able to analyse and quantify the image data automatically and without bias. We are looking for a motivated candidate, who would develop new image analysis algorithms for LSM and LiSM data, as well as extend and optimize already established image analysis pipelines. This will involve automatic detection and quantification of various regions of interest (ROI), such as cells and tissue areas, in 2D and 3D microscopy data of infected tissues and organs. For instance, one of the tasks will be to develop novel segmentation algorithms that identify individual ROI without applying fluorescence labelling. Another challenging aspect is handling the large amounts of 3D image data produced by LiSM, where effective algorithms need to be developed in order to find a balance between accurate data quantification and the utilization of computational resources in terms of time and memory. All developed algorithms will be applied to experimental data obtained from our collaboration partners in order to investigate actual biological questions from the field of infection biology.

Supervisor

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