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Modeling Viral Spread on Tissue or Cell Culture Level

Spreading of viral infections in tissues as well as in artificial cell cultures relies on various microscopical effects between individual cells. Besides the well known diffusion of free virions, which is primitive but important, experimentalist have recently discovered a vast variety of more or less elementary active and directed transport mechanisms (cf. [1], [2]). Amongst these *viral surfing* (cf. [3]) between cells is particularly interesting, since it may bridge significant distances. In these experiments transport of a few individual virions from a single infected towards a single uninfected cell (within a culture of only few cells) has been observed via different techniques such as live cell imaging and electron microscopy. To our knowledge the role of these transport processes on a larger scale has not yet been subject to any systematic studies — neither experimental nor theoretical.

To mathematically describe these phenomena a microscopic model including different contributions of transport and replication of viruses is set up and discussed. This is considered as a preparatory step towards an effective description of the overall viral transport on a meso-scale level. The future goal is to use homogenization techniques to gain more understanding for the role of these different microscopic processes for the quantitative and qualitative effects on spreading of viral infections in living tissues or cell cultures.

References

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