Modeling virus infection in cell culture

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Current *in vitro* studies of viral replication deliver detailed time courses of several virological variables, like the amount of virus and the number of target cells, measured over several days of the experiment. Each of these time points provides a snapshot of the virus infection kinetics and is brought about by the complex interplay of target cell infection, viral production and death. It remains a challenge to interpret this data quantitatively and reveal the kinetics of these underlying processes to understand how the viral infection depends on these kinetic properties. In order to decompose the kinetics of virus infection, we introduce a method to “quantitatively” describe the virus infection in *in vitro* cell cultures.

Employing our experimental-mathematical approach, we would like to discuss “two of virus infection modes” for HIV-1 infection. Virus infection could be classified into two infection modes: cell-to-cell infection and cell-free infection. Recent development of imaging technology revealed that the spread of HIV between immune cells is greatly enhanced by cell-to-cell infection. Furthermore, it was found that infection originating from cell-free virus decrease strongly in the presence of antiretroviral drugs whereas infection involving cell-to-cell spread are markedly less sensitive to the drugs. These evidences show that cell-to-cell infection is important target to achieve complete clearance of HIV during therapy. However, the underlying mechanisms of cell-to-cell infection (especially contribution of this mode) have been unclear. Here we are trying to estimate the contribution of cell-to-cell infection using HIV-1 cell culture system and a mathematical model.

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