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Generals die in friendly fire, or modeling immune response to HIV. (English) Zbl 1072.92028

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Summary: We develop a kinetic model for CD8 T lymphocytes (CTL) whose purpose is to kill cells infected with viruses and intracellular parasites. Using a set of first-order nonlinear differential equations, the model predicts how numbers of different cell types involved in CTL response depend on time. The model postulates that CTL response requires continuous presence of professional antigen-presenting cells (APC) comprised of macrophages and dendritic cells. It assumes that any virus present in excess of a threshold level activates APC that, in turn, activate CTL that expand in number and become armed "effector" cells. In the end, APC are deactivated after the virus is cleared. The lack of signal from APC causes effector cells to differentiate, by default, into "transitory cells" that either die, or, in a small part, become long-lived memory cells. Viruses capable of infecting APC will cause premature retirement of effector CTL. If transitory cells encounter a virus, which takes place after the premature depletion, CTL become anergic (unresponsive to external stimuli).

The model is designed to fit recent experiments on primary CTL response to simian immunodeficiency virus closely related to HIV and lymphocytic choriomeningitis virus. The two viruses are known to infect APC and make them targets for CTL they are supposed to control. Both viruses cause premature depletion and anergy of CTL and persist in the host for life.

MSC:

92C50 Medical applications (general)

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