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Modelling CD8 T-Cell Immune Response

This work has been made in collaboration with Christophe Arpin (INSERM U851, Lyon), Fabien Crauste (Univ. Lyon 1), Clarisse Dubois (INSERM U851, Lyon), Olivier Gandrillon (Univ. Lyon 1), Stéphane Genieys (Univ. Lyon 1), Isabelle Lemercier (INSERM U851, Lyon), Jacqueline Marvel (INSERM U851, Lyon)

The primary CD8 T-cell response, due to a first encounter with a pathogen, happens in two phases: an expansion phase, with a fast increase of T-cell count, followed by a contraction phase. This contraction phase is followed by the generation of memory cells. These latter are specific of the antigen and will allow a faster and stronger response when encountering the antigen for the second time. Several works recently proposed models of the CD8 immune response [1, 2, 3, 4]. Some of these works do not consider any regulation of the immune response [1, 2, 4], whereas others propose very detailed and complex models [3].

We will present two models of the primary response, in which nonlinearities account for molecular regulation of cell dynamics. The first one, inspired by [2], is based on ordinary differential equations. The second one, inspired by [1], is based on partial delay differential equations, and the delay takes into account the time cells take to differentiate from one state to the other one. We will discuss in particular the roles and relevance of feedback controls that could regulate the response. Then, we will show some simulations we can get from the models and confront them to experimental data. Finally, we will consider the problem at the molecular scale, with a model describing the network of molecular regulations in a T-cell during the immune response.

References

[1] R. Antia, V.V. Ganusov and R. Ahmed, *The role of models in understanding CD8+ T-cell memory* Nature Reviews **5** 101–111.

[2] R.J. De Boer, M. Oprea, R. Antia, K. Murali-Krishna, R. Ahmed and A.S. Perelson, *Recruitment Times, Proliferation, and Apoptosis Rates during the CD8 T-Cell Response to Lymphocytic Choriomeningitis Virus* J. Virology **75** 10663–10669.

[3] P.S. Kim, P.P. Lee and D. Levy, *Modeling regulation mechanisms in the immune system* J. Theor. Biol. **246** 33–69.

[4] I.M. Rouzine, K. Murali-Krishna and R. Ahmed, *Generals die in friendly fire, or modeling immune response to HIV* J. Computational and Appl. Math. **184** 258–274.