



Immune System Modelling and Simulation

Filippo Castiglione, Franco Celada

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The book describes a computational model of the immune system reaction, C-ImmSim, built along the lines of the computer model known as the Celada-Seiden model (CS-model). The computational counterpart of the CS-model is called IMMSIM which stands for IMMune system SIMulator. IMMSIM was written in 1992 by the physicist Phil E. Seiden and the immunologist Franco Celada. This model was built around the idea of developing a computerized system to perform experiments similar in vivo experiments; a tool developed to help biologists testing theories and hypothesis about how the immune system works.

C-ImmSim is best viewed as a collection of models in a single program. It incorporates the principal core facts of today's immunological knowledge, such as the diversity of specific elements, MHC restriction, clonal selection, thymic education of T cells, antigen processing and presentation (both the cytosolic and endocytic pathways are implemented), cell-cell cooperation, homeostasis of cells created by the bone marrow, hyper mutation of antibodies, maturation of the cellular and humoral response, and memory. Besides, an antigen can represent a bacterium, a virus, or an allergen or a tumor cell. C-ImmSim has been recently customized to simulate the HIV-1 infection. Moreover, it can simulate the immunotherapy for cancer. These features are all present in the code and people can choose to turn them on and off at compiling time.

The book presents the basic model as well as the various customizations to implement the description of different diseases and the way they have been used in practice to produce new knowledge either from hypothesis or from lab-experiment data. In this respect, the book can be used as a practical guide to implement a computational model with which to study a specific disease and to try to address realistic clinical questions.

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