

## **Mathematical Multi-scale modelling of the primary immune response by CD8 T-Cells using a maturity structured partial differential equation**

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CD8 T-cells play a key role during the immune response. Upon their first encounter with a given pathogen type, these cells proliferate and differentiate to undertake the infection. During this process, some of them differentiate into memory cells, whose role is to stay quiescent in the organism and trigger a specific and faster secondary immune response upon another encounter with the same pathogen. Vaccines are based on this principle : harmless pathogens are injected into the organism to trigger a primary response, thus generating memory cells to prepare the organism to a real infection.

Our work consists in modeling this phenomenon at two different, yet strongly interconnected physical scales, the intracellular scale and the population scale. At the intracellular scale, the production and activation of proteins belonging to a network has consequences on the fate of the cells. At the population scale, the CD8 T-cells are sorted into different sub-populations depending on their intracellular state and their interactions with other agents impacts their survival. The goal of this model is to reproduce biological data and give indications on optimal vaccination strategies.