

IMUDEMO: animated demonstration of the homeostatic immune model.

A model for a complex system is a metaphor and it contains sometimes heavy simplifications or deviations. A metaphor for the leg is the wheel: it offers the same service but in a rather different way. The following demonstration is a metaphor on the homeostatic immune model. It shows the basic ideas, connections but in a didactically reduced structure.

The first phase of the animation presents the work of a matured immune system: the body is over many infections, it is defended by a huge collection of antibodies what filters out all the known infections. The infections have colors: light or dark blue and silver. The filter is colored with the same colors and it catches all infections immediately. The number of antibodies is large enough thus there is no need for close contacts, any time an infection enters the body it is immediately eliminated.

The body is represented in a circle with an inside tube representing the lymph vessel. On the upper part are the cells in a tissue and below is the lymph node with a large antigen presenting cell (APC) in the center. On the edge of the lymph vessel are the T-cells. Tissue cells and T-cells have colors: red, yellow, white, brown, purple. Here again colors represent types of oligonucleotids. In case of a tissue cell this is the pattern positioned in the MHC of the cell. The fact, that in one cell there are many different MHC-s present is oversimplified here in the animation. Colors for T-cells mean the pattern what the T-cell learned already as a self pattern. We tacitly keep the postulate that one T-cell knows only one MHC-pattern. The animation shows the logic how the whole system is capable for the decision whether a fragment of a peptide is self or not. For such a decision one individual T-cell is unable. But in the immune system for all self fragments there is a T-cell which recognizes that individual fragment. In the animation we present the story of the fragments one by one which is again a simplification for in real situation all fragments flow parallel in the lymph vessel. And finally all will be filtered out, and the APC cell remains intact.

The third phase is the infection represented by the green color. It enters the body and chooses one cell changing its MHC pattern. The new pattern is no longer self and it crosses freely the lymph vessels. Finally it is caught by the APC which starts two independent processes. First sends a killer T-cell to locate and eliminate the infection. The T-cells follow different way, it need not to navigate in the lymph vessels. In the meantime the infected cell continues to infect the body and the outer world which is represented small green dots. The second action of the APC cell is to initiate the hypermutation of B-cells, which is rather slow. But we have time, the new antibody will serve only in a possible next infection. The last phase of the animation shows the restored immune defence enlarged now with the color green. Having the appropriate antibody the immune system heals the body but it can not eliminate the infection outside.