COMPUTER SIMULATION OF THE IMMUNE SYSTEM. James S. Bright*, Clifford A. Shaffer** Prakash S. Nagarkatti+ and Mitzi Nagarkatti+. Departments of Electrical Engineering*, Computer Science** and Biology+, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.

Computer simulation of biological systems allows researchers to carry out experiments quickly and inexpensively without the need for live subjects. We have created a computer simulation of the immune response which demonstrates classical primary and secondary immune responses to an antigen. The simulation records lists of information about each entity participating in "unusual" events occurring within the population of B cells, T cells and macrophages of a lymph node. Initially these event lists are empty as the cells are in a state of homeostasis. Simulation of infection is accomplished by introducing antigens into the simulated lymph node. This triggers the appropriate B cell which is then marked and placed on the B cell exception list. The B cell then processes the antigen and presents the peptide and MHC to the specific T helper cell. At this point the T cell is placed on the T cell list as an exception. The B cell–T cell interaction leads to a proliferation of memory B and T cells as well as plasma cells that produce antibodies. The reaction continues until the antigen is eliminated. This empties the antigen exception list, resulting in a return to the normal state, except for the new memory cells that were created. The entire process is a discrete event simulation with half hour time steps. This simulation and future extensions offer a potential tool to help us understand the complex cellular interactions that occur in the immune system with immunodeficiency, cancer and autoimmunity. Future work includes the modeling of cytotoxic T cells, interleukins and the idiotypic network hypothesis.