**Model adjustment from 2D to 3D**

The existing 2D code was analyzed and biological rules were extracted. Modeling eccentricities were noted and examined, including impacts of order-of-operations and non-randomization on simulation results. Data structures were examined and choices were made as to what parameters to keep in the 3D model based on desired instrumentation. Constants such as entry and exit points and probability distributions were initially adjusted based on best guess and refined based on simulation results. The biological rules were peer-reviewed and adjustments were made to fit with the most current knowledge of the lymph node. Adjustments were also made to fit with a 3D movement model (27 possible movement directions instead of 8) and this movement was further tuned to be consistent with the 2-photon movies.

Data structures were compressed as much as possible and code was re-written from scratch in C++ to support 3D and provide maximum optimization of memory accesses and to take advantage of parallelization capabilities, while not compromising the true randomness of the simulation by biasing it in any way (to ensure this, biological rules were implemented one-by-one and the results observed to verify the behavioral impact was as expected) – for instance, the order in which movement is processed can have a dramatic impact on the cell distribution after a period of time. Capabilities were also added to allow for grid expansion and contraction during and after an infection. After all of the rules were implemented, we compared the outputs to known lymph node characteristics and are presently engaged in tuning the model parameters to match.

A visualization application, Viz3D, was created that combines the simulation and visualization components of the software into one application allowing the viewer a complete picture of the simulation state, including the ability to start and stop, step, pan, tilt, and zoom. Cell types are depicted by different color sets/shapes and cell states are depicted by different shades of the same set. Cell movement is depicted by the orientation of oblong T cells as they are moving, providing a more natural feel and more closely matching the 2-photon videos. The FRC network can also be visualized, as well as the irregular shape of the simulation grid.