# NanoHUB + PhysiCell Warmup Exercise

## 1. Cell motility warmup.

This problem uses the cell motility model, which simulates the migration track of cells as they use a biased random walk. The tool is at https://nanohub.org/resources/trmotility

**How to run, view the simulation, and save images** Run the model with default settings by clicking the green "Run" button. Click on the "Out: Plots" tab, and drag the "frame" slider bar to advance through simulation frames. Download the final time as a reference case. (Advance the frame to the end (frame 26), right-click the image, "save image as", and give it a reasonable name like "motility_default.png"). Use this approach to quickly save snapshots of your runs.

**a. Impact of migration bias.** Go to the "User Params" tab to change parameter settings. Run the model again with the migration_bias at 0.2 and 0.5 and save the final frames. Plot the frames below (set widths to 2 inches): bias = 0.2, 0.5, 0.8. Comment on the impact of the bias parameter on the resulting cell tracks.

**b. Impact of persistence time.** Set the migration_bias at 0.5, and run the model again with the persistence_time set to 1 minute, 5 minutes, and 15 minutes. (Save the final frames as before). Plot the frames (set widths to 2 inches) for persistence = 1 min, 5 min, 15 min. Comment on the impact of the persistence time on the shape of the resulting cell tracks.

## 2. Three-Types Cell Laboratory

This model explores cell-cell interactions can leady to very complex dynamics.
The tool is at https://nanohub.org/tools/pc3types

**a. Default parameters.** Click "run" on the model with default parameters. Here, a tumor with 3 identical cell clones (magenta, green, cyan) grow while competing for diffusing resources. Describe the dynamics, and note the overall shape of the resulting tumor as it grows.

**b. Mutualism.** Suppose that Type A cells secrete a factor needed by Type B cells, and type B cells secrete a factor needed by type A cells. Go to "User Params", and set "A_cycle_B" to "promote" (factor B secreted by type B cells promotes cycling by type A cells), and set "B_cycle_A" to "promote". Click run to see what happens. Do A (magenta) and B (green) get an advantage over C (cyan) who goes it alone?

**c. Antagonism.** Now suppose that Type A cells and Type B cells are mutually antagonistic. Go to "User Params", and set "A_cycle_B" to "inhibit" (factor B secreted by type B cells inhibits cycling by type A cells), and set "B_cycle_A" to "inhibit". Click run to see what happens. How do A and B do compared to C?