Lab 1, Part 2: Can you learn any biology from physical measurements? Analysis of Cell Motion Using ImageJ.

This is the second week of a two-week lab studying cell motion. Last week we learned how to use Excel to analyze the 1-D motion of an amoeba. This week we will be learning how to use ImageJ to analyze videos of cell motion. **The Scenario: A patient has a wound, in the process of healing, that is infected with bacteria. Will the patient need antibiotics?** To explore this scenario, you will be analyzing videos of: 1) wound healing, 2) neutrophil motion, and 3) bacteria motion. Clearly, the relative speeds of the wound healing, the neutrophils, and bacteria will affect your decision. Thus it becomes important that we learn how to quantify the motion of cells and to analyze videos.

Your lab group has been provided with six video files—a long and a shorter version of each of the three processes, wound healing, neutrophil motion, and bacteria motion. Each video is a sequence of images called '**frames**.' Taken together, each video is an '**image sequence**' or '**stack**.' The wound healing videos, 'WoundHealing,' show breast tissue cell sheet migration. The 'Neutrophils' videos show white blood cells responding to six different concentrations of fMLP—the chemical indicator of bacteria. The bacteria videos show E. coli motion. By viewing the longer video files, you can begin to examine the qualitative aspects of our scenario. These videos are rich in detail but the files contain too much data to be analyzed in our limited lab time. From the shorter videos, your task is to perform a quantitative analysis, with ImageJ and Excel, of the rates of motion of these cells. This quantitative analysis should help you problem-solve within this scenario. Today you will practice and master the skills necessary to analyze motion using ImageJ. After today, you will ALL be expected to be experts at these skills, so take turns and help each other learn. Take notes for the future if you are worried that you will forget.

At the end of the lab **today, your group will submit one lab report**. This will be reviewed by the TA according to the Scientific Community Lab rubric. Good attention to detail now will save you time later! Remember, your TA is here to help you with equipment and ImageJ, but the physics is up to you and your group!

Video Files:

- Video files for **qualitative** analysis (long videos—large files)
  - Wound healing: WoundHealing.avi
  - White blood cells: Neutrophils.avi
  - Bacteria: E_Coli.avi

- Video files for **quantitative** analysis (shorter/smaller chunks of the long/large video files)
  - Wound healing: WoundHealing_25fps.avi; **All students analyze this!**
    - Technical specifications of video: 0.65 μm/pixel, 6.0 min/frame, playing at 25 frames/sec

- White blood cells: Neutrophils_25fps.avi; **Half of the groups** analyze this.
  - Technical specifications of video: 1.326 μm/pixel, 7.2 sec/frame, playing at 25 frames/sec
- Bacteria: E_Coli_25fps.avi; The **other half of the groups** analyze this.
  - Technical specifications of video: 156 pixels/μm, 0.050 sec/frame, playing at 25 frames/sec

Approximate Timing: (~2 hours)

- Introduction: …… 10 minutes
- Data Collection& Analysis, 1st video: ……. 30 minutes
- Class Discussion of 1st video: ……. 5 minutes
- Data Collection& Analysis, 2nd video: ……. 25 minutes
- Conferring with companion group, comparing all three videos: 10 minutes
- Class Discussion/Summation: ……. 10 minutes
- Finalizing Lab Report: ……. 20 minutes