Harvard-MIT Division of Health Sciences and Technology
HST.410J: Projects in Microscale Engineering for the Life Sciences, Spring 2007
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Projects in Microscale Engineering for the Life Sciences

Homework Assignment #2   Issued: February 15, 2007
                                             Due: February 27, 2007

Design an experiment to test some hypothesis about transport through cellular membranes using microfluidics. You and your partner can choose any topic you find interesting. Examples of good hypotheses include the following:

- **Osmosis.** Doubling the osmolarity of the extracellular solution by adding a large impermeant molecule (such as polyethylene glycol (PEG)) will make a cell shrink by a factor of two.

- **Permeability of ionic species.** Cell membranes are more permeant to potassium ions than to sodium ions.

- **Osmosis is colligative.** Adding the same molar volume of two different sugars (e.g., glucose and sucrose) will cause the same amount of cell shrinking.

- **Concurrent diffusion and osmosis.** Adding a permeant solute (such as dimethylsulfoxide (DMSO)) will cause a cell to first shrink and then swell back to its original volume.

- **Cell viability.** Dead cells will have smaller osmotic responses than live cells.

- **Lysis.** Adding a detergent (e.g., trisodium phosphate (TSP)) to the extracellular solution will dissolve the cell's membrane.

You may choose one of these hypotheses or develop your own original hypothesis. Design your experiment and discuss your plan with the staff. After your idea is approved, do your experiment and collect data. Your homework assignment is to write a short report (three pages, which is approximately 3×350 words) plus supporting images and graphs. Also submit photocopies of your lab notebook pages documenting your experiment.