2015 MRSEC Summer Course Announcement

We announce the opening of registration for our annual, one-week summer course, "Introduction to Microfluidics Technology" to be held at Brandeis University, near Boston, MA.

The microfluidics course is a hands-on laboratory course sponsored by the National Science Foundation's Bioinspired Soft Materials Research Science and Engineering Center (MRSEC) at Brandeis. It will be offered during the week of June 22 - 26, 2015. It is intended for graduate students, post docs, faculty and industrial scientists and engineers interested in utilizing microfluidic technology in their work, in both physical sciences and life sciences, and does not assume any specific prerequisites.

"Introduction to Microfluidics Technology" (June 22 – 26, 2015) will be taught by Dr. Dongshin Kim http://goo.gl/9a6y7Z.

A $750 fee will cover the course and housing in double-occupancy rooms with on-site breakfast and lunch from Monday through Friday. Single rooms are not available. Local students who do not need housing will pay a non-resident fee of $400.

Please bring this course to the attention of any appropriate scientists and engineers.

See the information below for a detailed course description.

Application Instructions

To apply, please email Katie Collings, (katie55@brandeis.edu) by March 31, 2015, with all of following materials attached in one email. Please write "MRSEC Summer Course Application" in the subject line.

- Name and gender (for housing)
- Housing needs (double or no-housing needed)
- Current CV
- Field of research
- Research advisor name (if applicable)
- A short paragraph explaining how your research work will benefit from the course for which you are applying

In addition, please have your research advisor write an email in support of your application from his/her university account. This email need only state that he/she approves of your attendance.

If accepted, students are required to take the online environmental health and safety trainings offered by the Boston Consortium (http://goo.gl/SkaXdU) before the second day of the course.

Applications will be reviewed on a rolling basis, and suitable students will be admitted as selected throughout the months of March and April. Further information for those admitted will be provided. If you have questions before applying, please email the Brandeis MRSEC Education Director, Dr. Anique Oliver-Mason (aniqueom@brandeis.edu).

MRSEC Summer Course: Introduction to Microfluidics Technology

Course Objectives:

This course is an introduction to the microfabrication technologies available to build microfluidic devices. This course has been created in response to the great interest from industry, government and academia in the field of microfluidics. We will build several microfluidic devices to understand the microscale phenomena and their applications. Throughout the course, we will place an emphasis on hands-on experimentation with microfluidic systems where laminar flow, surface tension, and molecular diffusion dominate.

Prerequisites

To get the most out of this course, it will help if you have some familiarity with basic conservation equations of mass, momentum, and heat, and classical thermodynamics. Some chemistry laboratory experience is recommended but not required.

However, students are required to take the online environmental health and safety trainings offered by the Boston Consortium (http://goo.gl/SkaXdU) before the second day of the course.

Course Description

The course is intended as in introduction for scientists and engineers interested in utilizing microfluidic technology in their research work.

Brandeis MRSEC Summer Course:
Introduction to Microfluidics Technology
June 22-26, 2015, Abelson 229, 9:30am-4:30pm

Instructor

Dr. Dongshin Kim	Abelson 209	781-736-2885	dongshin@brandeis.edu

Teaching Assistants Camille Girabawe cgira@brandeis.edu
Achini Opathalage atranaweera@gmail.com

Program Administrator

Dr. Anique Olivier-Mason	Abelson 325	781-736-2838	aniqueom@brandeis.edu

Course Overview

This course is an introduction to the microfabrication technologies available to build microfluidic devices. It was created in response to the interest from industry, government and academia to the field of microfluidics. Over five sessions, we will emphasize hands-on and independent experimentation of microfluidic systems where the forces of laminar flow, surface tension, and molecular diffusion dominate.

By the end of the course, students will be able to *apply* knowledge of micro-scale properties and *build* microfluidic devices for future-research applications.

Prerequisites

Before the course, students should:

- Possess a background in an experimental quantitative science. Preferably, one that includes the laws of conservation of mass and momentum, classical thermodynamic and an experience in a chemistry laboratory.
- Have AutoCAD installed on a computer and be able to create a basic shape (i.e. a circle or rectangle) using AutoCAD. There is a free student version: http://goo.gl/qc0Ixv
  Suggested tutorials are:
  - http://goo.gl/OmL7Sj
  - http://goo.gl/8j5y14
- Complete the online environmental health and safety trainings offered by the Boston Consortium (http://goo.gl/SkaXdU). This must be done before the second day of the course.

Attendance

In order to successfully complete the course and earn a certificate of completion, attendance is required at all five sessions. If an unexpected conflict arises, please contact the instructor.

Suggested Course Reading

- D. Kim, D.J. Beebe / Sensors and Actuators A 136 (2007) 426–433
- N. Sundararajan, D. Kim, A. Berlin / Lab Chip 5 (2005) 350–354
- https://gmwgroup.harvard.edu/pubs/pdf/1073.pdf
- http://goo.gl/6Qdzmk

Course Format

Students will work in 4 groups (A, B, C, and D) and rotate through different sessions.

Session	**Topics**	**Intended Learning Outcomes**
Welcome and overview of microfluidics	Introduction to the course and instructional staff Discussion on the use of microfluidics in future-research applications Introduction to microfluidics with basic theory Introduction to micro-fabrication technologies Introduction to liquid phase photo-polymerization ● Soft lithography ● Glass chips ● Hot embossing ● Photomask design Photomask design using AutoCAD	● List the methods for microfluidic fabrication ● Compare the steps in different microfluidic fabrication methods ● Apply basic theory regarding microfluidics to the development of a microfluidics device. ● Use AutoCAD to create a typical microfluidic design.
Liquid phase photopolymerization (L1 and L2)	Liquid phase photo-polymerization ● Fabrication (the designed photo mask will be printed using a regular office laser printer at this time)	Incorporate training to fabricate devices given a prepared photomask using the liquid phase photopolymerization method.
Liquid phase photopolymerization (L3)	Laminar flow and diffusion experiment	Complete simple experiments using devices produced during liquid phase photopolymerization training.

Soft-lithography (S1 and S2)	Training of master fabrication using photoresists	Incorporate training to fabricate masters given a prepared photomask.
PDMS (P1 and P2)	Training of PDMS molding and plasma bonding	Incorporate training to fabricate devices using masters produced during S1 and S2.
Microfluidics experiment (E1-4)	● Droplet generation and crystallization ● Concentration gradient generation based on diffusion, flow, and drop-on-demand ● Wrap up and course evaluation	Verify function of user-made device and observe microfluidic phenomena.