

The University at Buffalo Department of
Chemical and Biological Engineering
Presents

The 19th Annual Graduate Student Research Symposium

**“Microfluidics to Isolate Single and
Clusters of Rare Circulating Tumor Cells
to Manage Cancer Patients”**

Mehmet Toner, PhD

Helen Andrus Benedict Professor of
Biomedical Engineering

Massachusetts General Hospital,
Harvard Medical School

Harvard-MIT Health Sciences
& Technology

Friday, September 23, 2016

Center for the Arts
UB Amherst Campus

Student Lectures 1:00 p.m.
Keynote Presentation 2:00 p.m.
Screening Room

Student Poster Competition and
Alumni/Student Mixer 3:30-5:00 p.m.
Atrium

RSVP cbe-chair@buffalo.edu



University at Buffalo

Department of Chemical
and Biological Engineering

School of Engineering and Applied Sciences

The UB Department of Chemical and Biological Engineering

Graduate Student Research Symposium

Over the years the UB CBE Graduate Student Research Symposium has evolved into an exciting, comprehensive event that showcases the high quality, multidisciplinary research that is conducted in our department, and spans diverse areas such as molecular engineering of novel materials, nanotechnology, bioengineering, and molecular modeling. Every year our faculty and graduate students welcome the opportunity to present their work to their peers from CBE, other UB departments, our alumni, and representatives from local business. The Symposium has grown in ambition and scale, featuring over 60 posters, two lectures from senior graduate students, and a keynote lecture from an accomplished colleague. This year we are particularly pleased to welcome Mehmet Toner, PhD from Massachusetts General Hospital, Harvard Medical School, Harvard-MIT Health Sciences & Technology. Our Symposium will include a wine, beer, and hors d'oeuvres reception to honor our alumni and guests.



CBE is proud to present our 2016 PhD candidate speakers:

- **Liang Qiao (Swihart group):** "Solution phase synthesis of nanomaterials: morphology, mechanism and applications"
- **Shuen Shiuan Wang (Neelamegham group):** "Truncation of O-glycan biosynthesis by GalNTGc: an analog of naturally occurring N-acetylgalactosamine"

The UB Department of Chemical and Biological Engineering

This Symposium is a collaborative effort supported in part by the CBE Graduate Student Association, the UB CBE Advisory Board, our graduate student speakers, CBE faculty, and various colleagues in and around UB who serve as judges for the all-important student poster competition. Many thanks to all our graduate students who work so hard on their research, and for their excellent poster and oral presentations during the symposium. Ultimately, this Symposium is a showcase for the excellence that we strive for in our scholarship and graduate education. We look forward to many more years of this celebration of our research accomplishments.

“Microfluidics to Isolate Single and Clusters of Rare Circulating Tumor Cells to Manage Cancer Patients”

Mehmet Toner, PhD

*Helen Andrus Benedict Professor of Biomedical Engineering
Massachusetts General Hospital, Harvard Medical School
Harvard-MIT Health Sciences & Technology*

Abstract:

Viable tumor-derived circulating tumor cells (CTCs) have been identified in peripheral blood from cancer patients and are not only the origin of intractable metastatic disease but also markers for early cancer. However, the ability to isolate CTCs has proven to be difficult due to the exceedingly low frequency of CTCs in circulation. As a result their clinical use until recently has been limited to prognosis with limited clinical utility. More recently, we introduced several microfluidic methods to improve the sensitivity of rare event CTC isolation, a strategy that is particularly attractive because it can lead to efficient purification of viable CTCs from unprocessed whole blood. The micropost CTC-Chip (μ pCTC-Chip) relies on laminar flow of blood cells through anti-EpCAM antibody-coated microposts, whereas the herringbone CTC-Chip (HbCTC-Chip) uses micro-vortices generated by herringbone-shaped grooves to efficiently direct cells toward antibody-coated surfaces.

These antigen-dependent CTC isolation approaches, also called “positive selection,” led to the development of a third technology, which is tumor marker free (or antigen-independent) sorting of CTCs. We call this integrated microfluidic system the CTC-iChip, based on the inertial focusing strategy, which allows positioning of cells in a near-single file line, such that they can be precisely deflected using minimal magnetic force. The major advantage of the approach stems from the fact that it is based on “negative depletion” of blood cells and hence it is applicable to all solid tumors and does not require tagging or labeling the tumor cells. As a result the CTCs are isolated in pristine conditions and are amenable to analysis using imaging, molecular, and other approaches. We applied these three microfluidic platforms to blood samples obtained from lung, prostate, breast, colon, melanoma, and pancreatic cancer patients. This presentation will share our integrated strategy to simultaneously advance the engineering and microfluidics of CTC-Chip development, the biology of these rare cells, and the potential clinical applications of circulating tumor cells.

About Mehmet Toner:

Dr. Toner received a BS from Istanbul Technical University and a MS from the Massachusetts Institute of Technology (MIT), both in Mechanical Engineering. Subsequently he completed his PhD degree in Medical Engineering at Harvard-MIT Division of Health Sciences and Technology in 1989. Currently, he is the Helen Andrus Benedict Professor of Biomedical Engineering at the Massachusetts General Hospital, Harvard Medical School. His research interests are at the interface of engineering and life sciences including micro/nanotechnology and applications in clinical medicine. In 1994, he was recognized by the “YC Fung Faculty Award.” In 1998, Dr Toner was selected to become a “Fellow of the American Institute of Medical and Biological Engineering.” In 2007, he became a “Fellow of the American Society of Mechanical Engineers.”





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