

M-CNTC

NCI Alliance for Nanotechnology in Cancer

Midwest Cancer Nanotechnology Training Center

m-cntc.illinois.edu



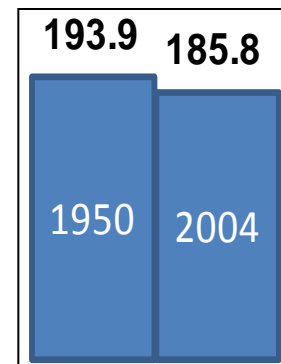
Co-PIs: Rashid Bashir and Ann Nardulli

Program Manager: Laura Miller

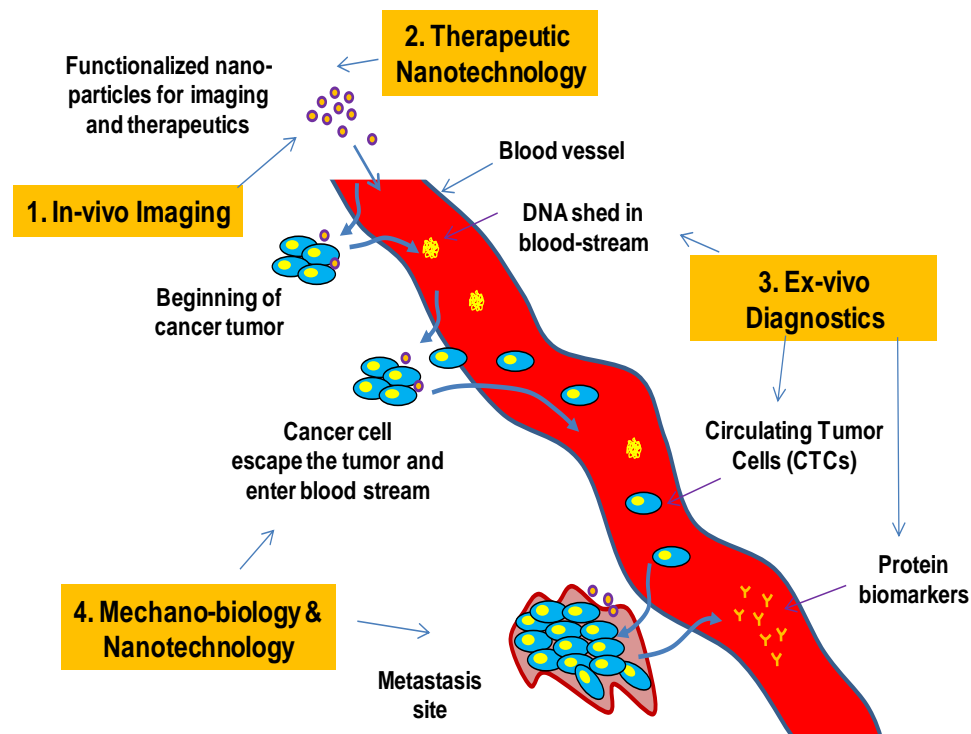
Management Support: Irfan Ahmad

Motivation and Vision

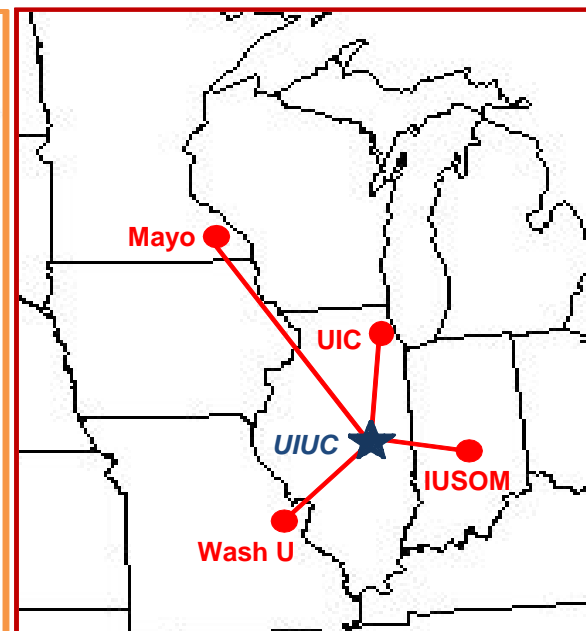
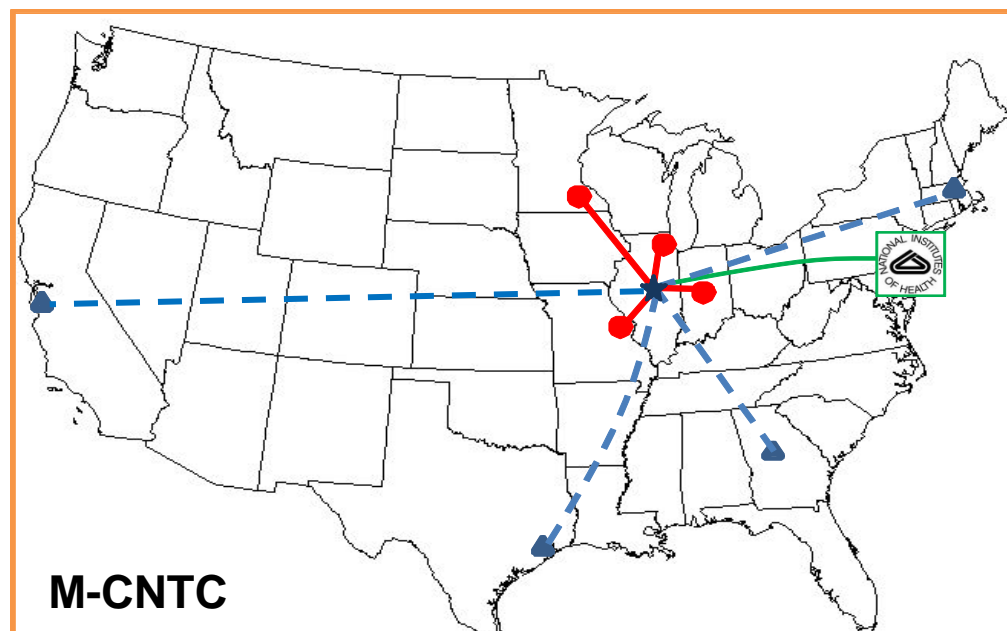
- Produce the next generation of leaders who will define the new frontiers and applications of nanotechnology in cancer research.
- More than a 1.5 million people were diagnosed with cancer and half a million died of cancer in US alone during 2009 (Cancer Statistics 2009, ACS).
- Limited success in reducing per capita deaths from cancer since 1950.
- New technologies and approaches are needed to address this urgent challenge.
- Response to NCI Alliance for Nanotechnology: M-CNTC



Cancer deaths/100,000



Clinical Partners



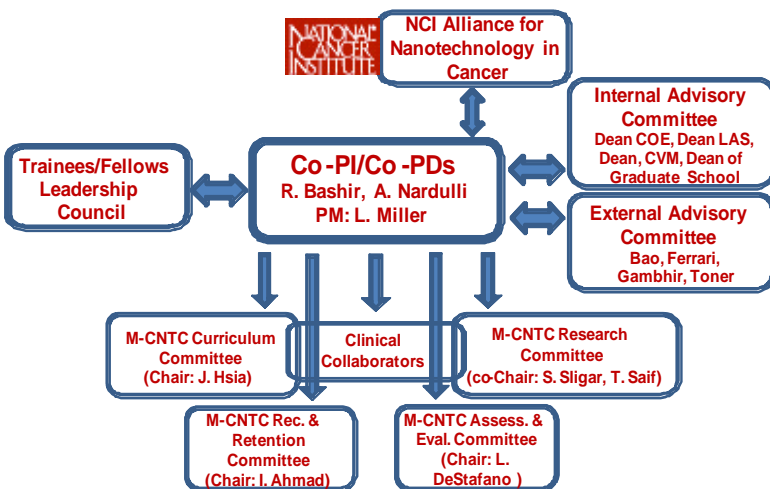
★ Central Hub, UIUC

● Clinical Partner Training Sites
(UIC, Mayo Clinic, IU School of Medicine,
Washington Univ. at St. Louis)

▲ External Advisory Board Members
(Stanford University, University of Houston,
Georgia Tech, Harvard Medical School)



Participants



#	Name	Title	Dept/Unit Affiliation	Proposed Role
1	Ahmad, Irfan	Assoc Director	CNST/MNTL	Program Manager
2	Bailey, Ryan	Assistant Professor	Chemistry	Participant
3	Bashir, Rashid	Professor/Director	ECE/BioE/MNTL	PI/Co-Program Dir.
4	Bhargava, Rohit	Assistant Professor	BioE/Beckman	Participant
5	Boppert, Steve	Professor	ECE/BioE/Beckman Institute	Participant
6	Cheng, J. J.	Assistant Professor	Material Science and Engr	Participant
7	Clegg, Robert	Professor	Biophysics	Participant
8	Cunningham, Brian	Associate Professor	ECE/BioE/MNTL	Participant
9	Destefano, Lizzanne	Prof/Assoc. Dean	I-STEM/College of Education	Evaluator
10	Choi, S.	Research Professor	ECE	Participant
11	Fan, Tim	Assistant Professor	Veterinary Clinical Medicine	Participant
12	Ha, Taekjip	HHMI/Professor	Physics/Biophysics	Participant
13	Helferich, William	Professor	Food and Nutrition	Participant
14	Hsia, Jimmy	Prof/Assoc. Dean	MechSE/MNTL	Participant
15	Insana, Michael	Professor/Head	BioE	Participant
16	Jeffery, Elizabeth	Professor	Food and Nutrition	Participant
17	Katzenellenbogen, J.	Professor	Chemistry	Participant
18	Kim, Kevin	Professor	ECE	Participant
19	Kong, Hyunjoon	Assistant Professor	ChBE/IGB	Participant
20	Kuhlen Schmidt, Mark	Professor	Pathobiology	Participant
21	Liu, Gang 'Logan'	Assistant Professor	ECE/MNTL	Participant
22	Lu, Yi	Professor	Chemistry	Participant
23	Murphy, Catherine	Professor	Chemistry	Participant
24	Nardulli, Ann	Professor	Molecular and Cell Biology	PI/Co-Program Dir.
25	Saif, Taher	Professor/Director	MechSE/MNTL	Participant
26	Sligar, Steve	Professor/Head	Molecular and Cell Biology	Participant
27	Watkins, Ken	Professor	Applied Health Sciences	Participant
28	Wang, Peter	Assistant Professor	BioE/Physiology/Beckman	Participant

Collaborating Institutions: US-wide (See Letters of Support)			
1	Clare, Susan	Professor/Surgeon	IU SOM/Simon Cancer Center Clinical Partner, research collaborator
2	Sledge, George	Professor/Oncologist	IU SOM/Simon Cancer Center Clinical Partner, Amelia project coordinator
3	Kruh, Gary	Professor/Director	UIC Cancer Center Clinical Partner; joint seed grant program
5	Prendergast, Frank	Professor/Director	Mayo Clinic Center for Individualized Medicine Clinical Partner; UIUC-Mayo Collaborator lead
6	Vasmatzis, George	Research Scientist	Mayo Clinic Center for Individualized Medicine/Cancer Center Clinical Partner, research collaborator
7	Wickline, Sam	Professor	Washington University/ Siteman Cancer Center Clinical Partner, research collaborator, Wash U CCNE PI

External Advisory Committee

- Bao, Gang Professor/Director Georgia Institute of Technology/Emory*
- Ferrari, Mauro Professor University of Houston*
- Gambhir, Sanjiv S. Professor/Director Stanford University School of Medicine*
- Toner, Mehmet Professor/Director Harvard University/MGH*

Remembrance:

With fond memories we remember
Our esteemed colleague and collaborator
Dr. Gary Kruh, Director, UIC Cancer Center
who recently passed away

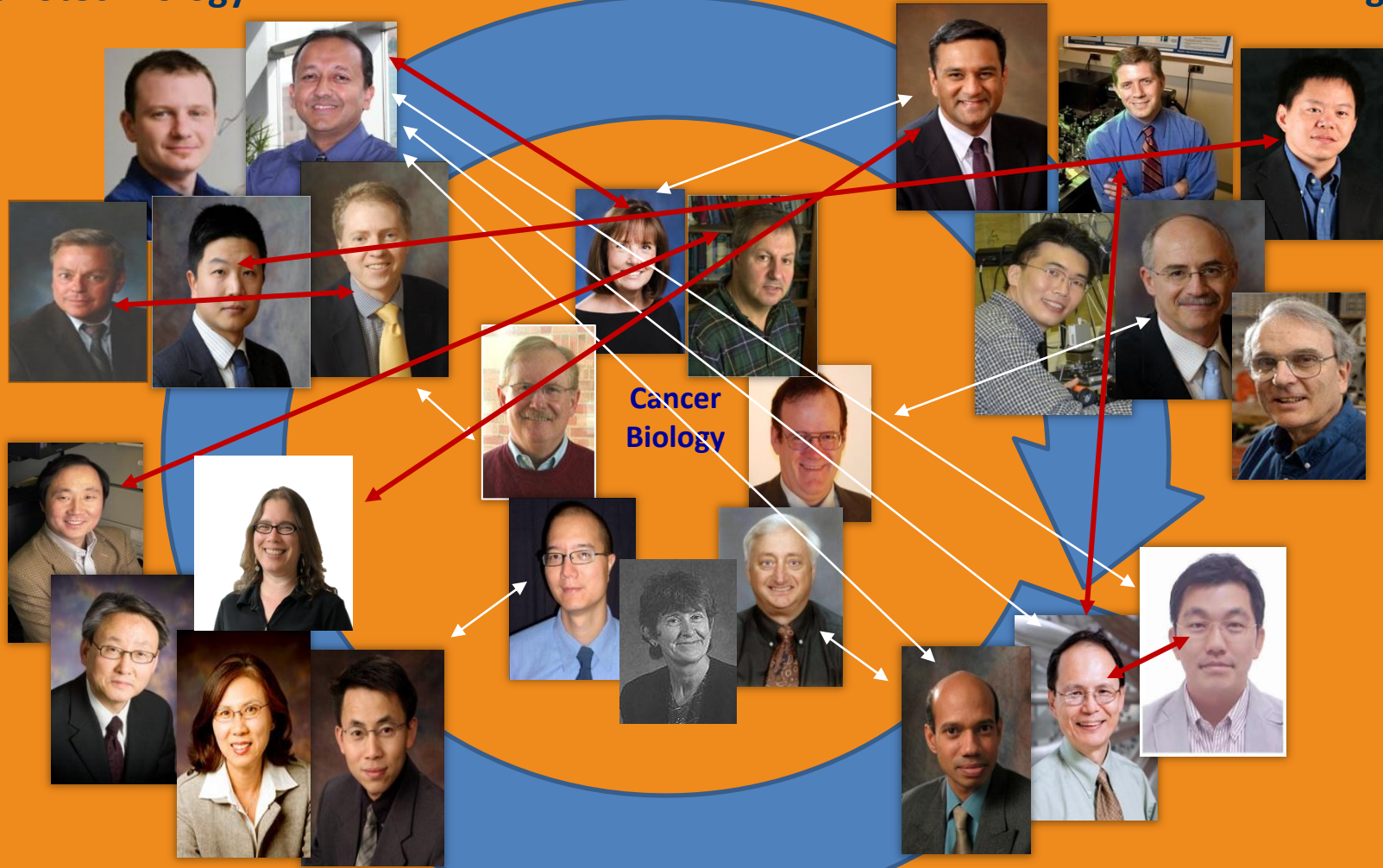
**Focus Area 1: Ex-vivo Diagnostics
Nanotechnology**

**Focus Area 2: In-vivo Imaging
Nanotechnology**

**Cancer
Biology**

**Focus Area 3: Therapeutic
Nanotechnology**

**Focus Area 4: Mechanobiology
and Nanotechnology**

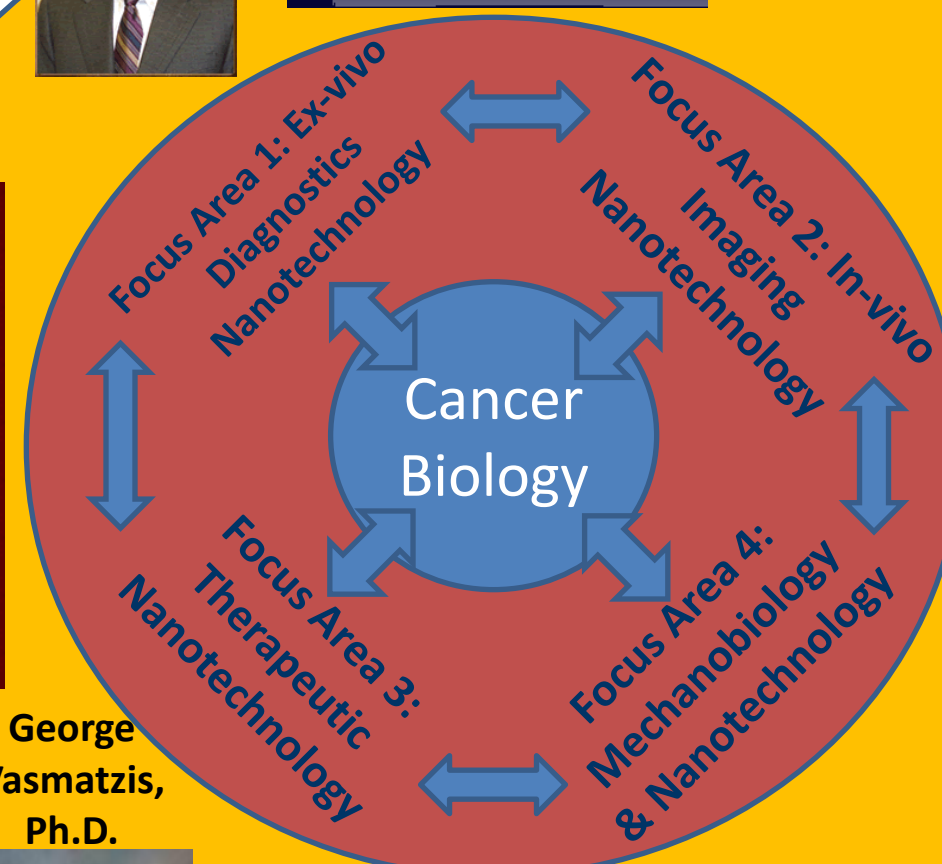


Gary Kruh
M.D., Ph.D.



- Seed grant program (\$400K per year)

Susan E. Clare
M.D., Ph.D.



Samuel A. Wickline, M.D.



Franklyn G. Prendergast,
M.D., Ph.D.



George Vasmatazis,
Ph.D.



- MOU signed on individualized medicine
- Seed grant program

University of Illinois College of Medicine at Chicago • UIC Cancer Center • For Researchers • 2010 Pilot Project Grant Guidelines Announced

2010 Pilot Project Grant Guidelines Announced

2010 Pilot Project Grant Program

This pilot project program is made possible by support from the UIC Health Science Colleges and the Office of the Provost.

1. Purpose

To foster high quality interdisciplinary cancer research collaborations between:

- Cancer researchers at Urbana, Peoria, or Rockford and the four UIC Cancer Center research programs; or
- Cancer researchers in the four UIC Cancer Center research programs.

The 4 UIC Cancer Center research programs are:

- **Cancer Control and Population Science**
- **Carcinogenesis and Chemoprevention**
- **Experimental Therapeutics and Imaging**
- **Tumor Cell Biology**

Mayo Clinic - Mayo Clinic and University of Illinois Create Research Alliance

Page 1 of 2



Mayo Clinic and University of Illinois Create Research Alliance Mayo Clinic-University of Illinois strategic alliance for technology-based health care

Tuesday, June 22, 2010

ROCHESTER, Minn. — Mayo Clinic and the University of Illinois at Urbana-Champaign are announcing a strategic alliance designed to promote a broad spectrum of collaborative research, development of new technologies and clinical tools, and design and implementation of novel education programs. Both parties recently signed an agreement establishing the formal relationship.

This Mayo Clinic - Illinois strategic alliance provides a framework for broad cooperation in individualized medicine by integrating efforts in three areas:

- Basic, translational and clinical research
- Bioengineering, especially for point-of-care diagnostics
- Development of tools and methods in computational biology and medicine

"We are utterly delighted to be working with Illinois. We have worked diligently over the past eighteen months to get to this point," says Franklyn Prendergast, M.D., Ph.D., director of the Mayo Clinic Center for Individualized Medicine. "What now emerges is a plan that builds on complementary capabilities of the two institutions in science and medicine honed and strengthened by the similarities in our midwestern cultures and values."

Vision for the M-CNTC Traineeship

- Provide an interdisciplinary and integrative educational environment
- Train pre-doctoral and post-doctoral fellows to be critical, innovative thinkers across disciplines
- Foster leadership, communication, and team building skills to produce future leaders in science and society

Year 1 Trainees



Adeel Ahmad

Electrical and Computer
Engineering (4th Year)

PIs: Stephen Boppart
and Jimmy Hsia

**Investigate the Microenvironment of
Cancer Cells and Tissues Using
Magnetic Nanoparticles**



Muhammad Yakut Ali

Mechanical Science and
Engineering (1st Year)

PIs: Taher Saif and Mark
Kuhlenschmidt

**Study the Effects of Mechanical Stimuli on
Cancer Cells**

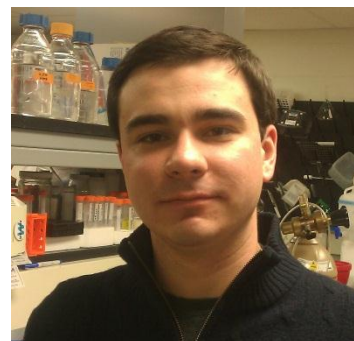


Ross DeVolder

Chemical and Biological
Engineering (3rd Year)

PIs: Hyunjoon Kong and
Jimmy Hsia

**Develop Biomaterials that Elicit Cellular
Responses for Biomedical Applications**



Michael Gregory

Biochemistry (2nd Year)

PIs: Steve Sligar, Brian
Cunningham, and Paul
Hergenrother

**Develop Next-Generation Therapeutics for
the Treatment of Androgen Responsive
Malignancies**

Year 1 Trainees

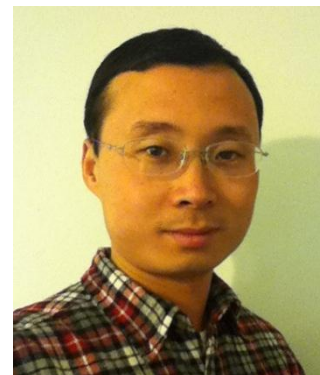


Austin Yin Kyai Hsiao

Bioengineering (2nd Year)

PIs: Logan Liu and Yingxiao
Peter Wang

**Study Cancer Cell Mechanobiology in
Metastasis**



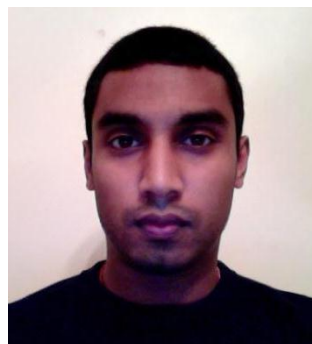
Huan Li

Mechanical Science and
Engineering (5th Year)

PIs P1: Stephen Boppart and
Jimmy Hsia

PIs P2: Hyunjoon Kong and
Jimmy Hsia

**Probe the Microenvironment of Cancer
Cells using Magnetic Nanoparticles**



Sean Sivapalan

Materials Science and
Engineering (4th Year)

PIs: Catherine Murphy and
Rohit Bhargava

**Develop Highly Sensitive Methods of
Detecting Pre-metastatic Cancer Cells**



Li Tang

Materials Science and
Engineering (4th Year)

PIs: Jianjun Cheng and
Timothy Fan

**Develop Novel Nanoconjugates for Cancer
and Diabetes Treatment**

Year 1 Trainees



Murali Venkatesan

Electrical and Computer
Engineering (5th Year)

PIs: Rashid Bashir and
Ann Nardulli

**Develop Biomedical Sensors for Early
Cancer Detection**



Brian N. Y Wong

Materials Science and
Engineering (4th Year)

PIs: Yi Lu and William
Helferich

**Develop Nanoconjugates for In Vivo Cancer
Imaging and Drug Delivery**

Year 2 Trainees



Brian Dorvel

Biophysics (4th Year)

PIs: Rashid Bashir and
Susan Clare (IUSOM)

**Integrated BioChips for Detection of Cancer
Proteins from Breast Aspirate Fluids**



William Ilya Goldshlag

Electrical and Computer
Engineering (3rd Year)

PIs: Brian Cunningham
and Yi Lu

**Label-Free Identification of Cancer Cells
using Aptamers and Laser-Based Biosensors**



Sarah Holton

Bioengineering (4th Year)

PIs: Rohit Bhargava
and Ann Nardulli

**Understanding Molecular Crosstalk During Breast
Cancer Progression using New 3D Cell Culture
Models with Nano-microstructured Detail**



Katrina Keller

Bioengineering (1st Year)

PIs: Rashid Bashir and
Supriya Prasanth

**Explore Cancer Cell Stiffness and Physical
Properties using Silicon MEMS Sensors**

Year 2 Trainees

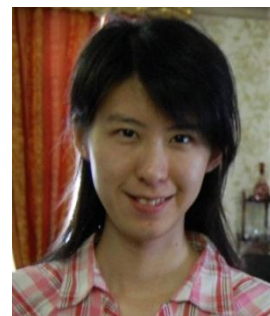


Vahid Mirshafiee

Chemical and Biomolecular
Engineering (2nd Year)

PIs: Jianjun Cheng
and Mary Kraft

**Click Chemistry Induced Nanomedicine
Cancer Targeting**



Yue Wang

Bioengineering (3rd Year)

PIs: Michael Insana
and Steven Boppart

**Investigating Mechanoenvironment
Change in Tumor Growth Using
Multimodal Contrast Agents**

Trainee Demographics

- Overall – 16 Trainees have been appointed (2 have graduated)
 - Engineering: 14 (BioE, ChemBE, ECE, MatSE, MechSE)
 - Non-engineering: 2 (Biochemistry, Biophysics)
- Goals
 - Increased participation from trainees outside engineering
 - Include students from underrepresented groups
- Total of 7 new slots for Year 3 trainees to begin Fall 2012
 - Majority of Year 3 Trainees will be chosen from existing PhD students
 - 2 SURGE/M-CNTC Trainees will be new recruits or continuing Master's students

Components of the M-CNTC Traineeship

1. Co-advisement

- Ensure scholarly research that is truly interdisciplinary
- Typically the Co-PI serves as the co-adviser

2. Interdisciplinary Curriculum

- Interdisciplinary solutions to address complex problems in health care, and especially cancer, call for an interdisciplinary curriculum that will educate and equip a new generation of scientists to face these challenges
- Intent is to make the program as synergistic with your existing PhD program and requirements
- Purpose of this two-track system (found on the next slide) is to fill in gaps in your educational background so that you will be ready to start research in this interdisciplinary area as early as possible
- The interdisciplinarity of each students' curriculum will be part of the assessment and evaluation of the program

Conceptual Curriculum Schematic

ABE = Agricultural & Biological Engineering
 BIOE = Bioengineering
 ECE = Electrical & Computer Engineering
 MCB = Molecular & Cellular Biology
 ME = Mechanical Engineering
 PHYS = Physics, BIOP=BioPhysics
 TAM = Theor. & Appl. Mechanics
 VB = Veterinary Biosciences

BioNanotechnology and Nanomedicine: Applications in Cancer and Mechanobiology

■ = Cancer Biology grad programs
 ■ = Engineering/Physics grad programs
 ■ = All Cancer Nanotechnology Center students
 ■ = New Courses

Lab Modules

Cell & Molecular Biology

- Basic and Advanced Cell Culture
- Advanced Cell Subs.
- DNA and Proteins

Nanofabrication

- Nanofabrication Methods
- Nanofabrication of Cell Sensors
- Micro-fluidics

Imaging

- Advanced Microscopy
- Single Molecule Visual.
- Cell Visualization
- Cell Force Probes

Computation

- Computational Molecular Biology
- Biology Student Workbench

Physics for Biologists, new

- Biological Nanoengineering, ABE 446

- Cell Structure and Function MCB 400

- Cell Biology for Engineers, MCB new

- Mechanics of Biological Solids, ME 498

- Computational Chemical Biology, BIOP 470

- Non equilibrium Stat. Mechanics, PHYS 598BSN

- Introduction to System Biology for Engineers, ECE 498

- Introduction to Biological Physics, 498Bio

- Cell and Membrane Physiology MCB 401

- Biomolecular Materials Science, MSE 473

- Diet and Cancer NUTR SCI 590

- Molecular Cell Biology, MCB 501

- Special Topics: Targeting Tumor, CDB 529

Career Module

- Communication skills
- Leadership skills
- S&T Policy
- Patent and IP
- Industry environment
- Entrepreneurship

Advanced Courses

- Molecular and Cellular Bioengineering, BIOE 461v

- Mechanobiology for Engineers ME 598

- Physical Biology: From Single Molecule to Sys. Biol., PHYS 5981

- Physics of Nanomachines PHYS 598NM

- Nanotechnology in Cancer Research Seminar Series

- Semiconductor Nanotechnology Lab ECE 583

- Biomolecular Physics, BIOP 550

- Veterinary Immunology Pathobiology 632

- Biomedical Applications of Nanotechnology (videolink) BioE 598WU

- Design and Use of Biomaterials MSE 470

- Comparative Oncology Pathobiology 555

- Special Topics in Cell Biology MCB 592

Components of the M-CNTC Traineeship

3. Enrollment in “BioNanotechnology and Nanomedicine: Applications in Cancer and Mechanobiology”

— **Nanotechnology and Nanomedicine (Rashid Bashir)**

- BioMEMS and Microfluidics
- Micro and Nanofabrication
- Lab on a Chip

— **Cancer Biology (Ann Nardulli)**

- Characteristics of Cells
- Metastasis
- Role of various agents in cancer

— **Cancer and Nanotechnology (Catherine Murphy)**

- Therapeutic Nanotechnology
- Diagnostic Nanotechnology
- Imaging Nanotechnology

— **Cellular Mechanics and Nanotechnology (Taher Saif)**

- Mechano-transduction
- Forces and measurements
- Role of mechanical environment on cancer

Components of the M-CNTC Traineeship

4. Summer School

- Technical modules and hands-on laboratory experience
- Trainees will be involved in the Summer School at an appropriate level based on experience

— Key Lecture Topics

- Cell and Molecular Biology
- Cancer Cell Biology
- Micro and nanofabrication
- Microfluidics in biology and medicine
- Neuroscience and Microfluidics
- Mechanobiology
- Therapeutic nanotechnology
- Diagnostic devices and nanotechnology
- Nanotechnology based imaging in cancer
- Stem Cell Biology
- Computational nanomechanics

— Key Lab Modules

- Cancer Cell Biology
- Molecular Biology
- Micro and Nanofabrication
- Micro-fluidics and Enabling Technologies
- Therapeutic Nanotechnology
- Mechanobiology

BioNanotechnology Summer Institute 2011



<http://www.cnst.illinois.edu/bionanoinstitute.html>

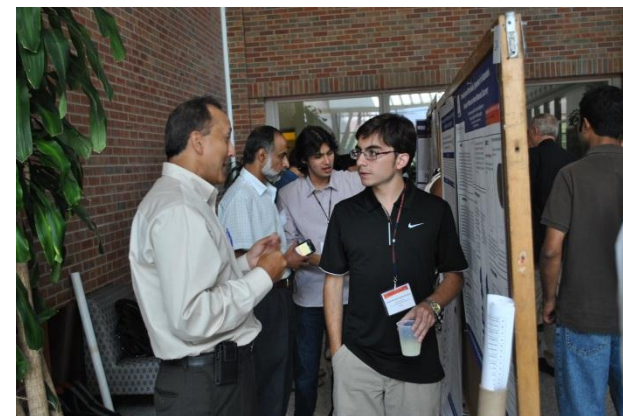
BSBA in Taiwan – Summer 2011

<http://bsbasi-2011.mechse.illinois.edu>

Previous Summer Schools

<http://gem4-2009.mechse.illinois.edu/index.php>

<http://bsbasi-2010.mechse.illinois.edu/>



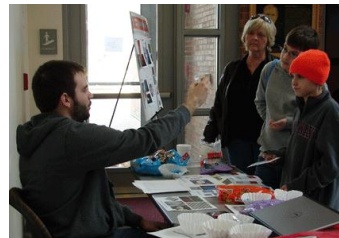
Components of the M-CNTC Traineeship

5. Participation in the Seminar Series and Annual Symposium

- Student Leadership Council (SLC) – comprised of 3 students on a 1-2 year rotation
 - Organize seminar series (in conjunction with CMMB IGERT SLC)
 - Attend M-CNTC Executive Committee Meetings
 - Provide a communication channel between/among students and faculty/administration
 - Publicize opportunities for travel grants, professional development workshops, lectures from leading researchers, outreach opportunities, and mentoring programs
 - Organize social events for trainees
- Seminar series is intended to foster scientific discussion, led and organized by the SLC, invite faculty and trainees to give presentations
- Annual Symposium

Other M-CNTC Traineeship Activities

- Clinical Partner Experience
- Outreach
 - Engineering Open House



- Elementary School Tours



- Brain Fitness Friday's with TEC
- Farmer's Market in Urbana



Outreach Activities – get them as early as we can!

→ Introduction to ‘Nanotechnology’ for 4th – 8th Graders

MNTL Contributes Expertise and Photos for Children’s Book on Nanotechnology

Nanotechnologist is the most recent addition in the series on “Cool Science Careers,” published by Cherry Lake Publishing in Chicago. In addition to explaining the technology and related careers at an introductory fourth-grade level, the book also features several photographs taken at the Micro and Nanotechnology Laboratory (MNTL) at the University of Illinois.

“Our laboratory was originally contacted by Pam Rosenberg on behalf of the publisher, searching for images that can be used on the cover and in the interior of this children’s book,” explained Rashid Bashir, professor in both the Department of Electrical and Computer Engineering and Department of Bioengineering. Photos from a number of research groups’ students and laboratories were used for the book. Bashir and Irfan Ahmad, associate director of the Center for Nanoscale Science and Technology (CNST) at Illinois, both reviewed the book’s content for the publisher. Copies of the book can be ordered by writing to debby@illinois.edu.



Author: [Ann Heinrichs](#)

Ann Heinrichs is the author of more than 200 books for children and young adults. They cover U.S. and world history and culture, science and nature, and English grammar. Ann has also enjoyed careers as a children’s book editor and an advertising copywriter.

→ Introduction to ‘Bio-engineering’ for 4th -8th Graders



Assessment and Evaluation

- Internal evaluator: Lizanne DeStefano and associates from the College of Education
- The evaluation is designed to answer four questions:
 - Implementation: Is the M-CNTC program being implemented on schedule and as planned?
 - Effectiveness: Are key components of the M-CNTC model (e.g. student recruitment, faculty involvement, introductory course, co-advising, laboratory modules, new courses, seminars, internships, Student Leadership Council, etc.) operating effectively? How might they be improved?
 - Impact: What outcomes are associated with participation in the M-CNTC program? How do these compare with a comparable group of students in traditional programs? What is the value-added of participation in the M-CNTC program?
 - Institutionalization: How and to what extent are elements of the M-CNTC becoming institutionalized at Illinois and other participating institutions? What opportunities and barriers exist?



Assessment and Evaluation

- Pre and Post Surveys (first one goes live September 9, 2011)
- Progress Report Form
 - Summary of research project progress to date
 - Intended outcomes in the next six months
 - Courses taken, scientific meetings attended, talks given
 - Publications
 - Due a couple of months before the end of your traineeship year
- Event Evaluations
- Interviews and Focus Groups
- Interim and Annual Report Data
 - Interim report due December 15
 - Annual report due June 1

Questions and Comments?

m-cntc.illinois.edu

Program Manager:
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