2011 GEM$^4$ Summer School Program on Cellular and Molecular Machines with a focus on Biological Machines

June 20 – 30, 2011

Labs and demos will be held at locations specified in the Program
Note: lab/demo module groups are divided per attendees’ last names

Georgia Institute of Technology
Phone: 404.385.7177

Monday, June 20 – Cell Biology

Lecture Venue: Marcus Nanotechnology Building, Room 116-118

08:00 – 09:00 am  Registration and Breakfast at Marcus Nanotechnology Building Atrium

09:00 – 09:10 am  GEM$^4$ Summer School Welcome Remarks
Larry McIntire, Chair of Biomedical Engineering; GA Tech and Emory University

09:10 – 09:20 am  GEM$^4$ Summer School Overviews
Gang Bao, GA Tech

09:20 – 10:10 am  Lecture 1: Cystic Fibrosis: A Multi-organ Disease Due to Mutations in One Complicated Molecular Machine
Nael McCarty, Children's Healthcare of Atlanta

10:10 – 10:30 am  Break

10:30 – 11:20 am  Lecture 2: Evolution of Development - Recent Work Linking Cilia Function to Development & Disease
Todd Streelman, GA Tech

11:30 – 12:20 pm  Lecture 3: Microfluidics and Applications in Biomedical Sciences
Hang Lu, GA Tech

12:30 – 02:00 pm  Lunch/Trainees Introduction & Poster Session

02:00 – 04:00 pm  Safety Training
Steve Woodard, GA Tech
**Tuesday, June 21 – Stem Cell Biology**

**Lecture Venue:** Marcus Nanotechnology Building, Room 116-118

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<td>08:00 – 09:00 am</td>
<td>Registration and Breakfast at Marcus Nanotechnology Building Atrium</td>
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| 09:00 – 09:50 am | Lecture 4: *Engineering of 3D Stem Cell Microenvironments to Direct Differentiation & Morphogenesis*  
**Todd McDevitt,** GA Tech |
| 10:00 – 10:50 am | Lecture 5: *Clinical Translation of Cellular Therapy*  
**Ian Copland,** Emory University |
| 11:00 – 11:50 am | Lecture 6: *Computational Structural Biology*  
**Steve Harvey,** GA Tech |
| 12:00 – 01:00 pm | Lunch and Poster Session |
| 01:00 – 03:00 pm | Molecular and Cell Biology Labs (two 2-hour sessions)  
**Attendees with Last Name: A-M will attend Cell Culture Lab**  
(Last Name A-G) Presentation Venue: Cherry Emerson Building, Room 316  
(Last Name H-M) Technique Venue: Cherry Emerson Building, Room 330  
• Swap after one hour |
| 03:00 – 05:00 pm | Molecular and Cell Biology Labs (two 2-hour sessions)  
**Attendees with Last Name: A-M will attend Electrophoresis Lab**  
Venue: Cherry Emerson Building, Room 123 |
| 03:00 – 05:00 pm | Molecular and Cell Biology Labs (two 2-hour sessions)  
**Attendees with Last Name: N-Z will attend Cell Culture Lab**  
(Last Name N-S) Presentation Venue: Cherry Emerson Building, Room 316  
(Last Name T-Z) Technique Venue: Cherry Emerson Building, Room 330  
• Swap after one hour |
**Wednesday, June 22 – Molecular Biology**

**Lecture Venue:** Marcus Nanotechnology Building, Room 116-118

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| 09:00 – 09:50 am | Lecture 7: The Central Dogma of Molecular Biology in the Omics Era  
                Al Merrill, GA Tech                                                             |
| 10:00 – 10:50 am | Lecture 8: Overview of Cancer Molecular Biology and the Integration of Recent Finding in the Development of Therapeutic and Diagnostic Nanotechnologies  
                John McDonald, GA Tech                                                        |
| 11:00 – 11:50 am | Lecture 9: Human Pluripotent Stem Cell Differentiation in Adherent Cell Cultures  
                Steve Stice, Aruna Biomedical                                                   |
| 12:00 – 01:00 pm | Lunch and Poster Session                                                                |
| 01:00 – 03:00 pm | Stem Cell Biology Tutorial (two 2-hour sessions)  
                **Attendees with Last Name: A-M**  
                **Venue:** Institute of Bioengineering and Bioscience (JBB), Room 1128          |
|                | Molecular and Cell Biology Lab (two 2-hour sessions)  
                **Attendees with Last Name: N-Z**  
                (Last Name N-S): Fluorescent microscopy  
                (Last Name T-Z): Cell Staining                                                    |
|                | **Venue:** Cherry Emerson Building, Room 330                                              |
| 03:00 – 05:00 pm | Stem Cell Biology Tutorial (two 2-hour sessions)  
                **Attendees with Last Name: N-Z**  
                **Venue:** Institute of Bioengineering and Bioscience (JBB), Room 1128          |
|                | Molecular and Cell Biology Lab (two 2-hour sessions)  
                **Attendees with Last Name: A-M**  
                (Last Name A-G): Fluorescent microscopy  
                (Last Name H-M): Cell Staining                                                    |
|                | **Venue:** Cherry Emerson Building, Room 330                                              |
Thursday, June 23 - Imaging

Lecture Venue: **Marcus Nanotechnology Building, Room 116-118**

08:30 – 09:00 am  Breakfast

09:00 – 09:50 am  Lecture 10: *A Hard Day in the Life of a Soft Cell*
Jeff Fredberg, Harvard University

10:00 – 10:50 am  Lecture 11: *The Current State of Live-Cell and Sub-Diffraction Limited Fluorescence Microscopy*
Phil Santangelo, GA Tech

11:00 – 11:50 am  Lecture 12A: *Applications of MRI in Biomedical Engineering*
Johannes Leisen, GA Tech

Lecture 12B: *CT Basis*
Angela Lin, GA Tech

12:00 – 01:00 pm  Lunch

**AFTERNOON**  Imaging Labs

1:00 – 1:30 pm   Tour of Image Facilities
Attendees with Last Name: A-M will tour MRI Facility
Attendees with Last Name: N-Z will tour CT Facility
Venue: Institute of Bioengineering and Bioscience (IBB), Basement

1:30 – 2:00 pm   Tour of Image Facilities
Attendees with Last Name: A-M will tour CT Facility
Attendees with Last Name: N-Z will tour MRI Facility
Venue: Institute of Bioengineering and Bioscience (IBB), Basement

2:00 – 5:00 pm  Instructional: Demonstration of a Life MRI Scanner
Venue: UA Whitaker Building (BME), Room 1103

06:00 – 09:00 pm  Dinner
Peachtree Club
999 Peachtree Street, NE, 28th Floor, Atlanta, GA 30309
Located on the corner of 10th Street and Peachtree Street
404.817.0999
Attire: Business Casual
*(Shorts, jeans, t-shirts, & tennis shoes are not appropriate)*
Friday, June 24 – Biomechanics

Lecture Venue: Marcus Nanotechnology Building, Room 116-118

08:30 – 09:00 am  Breakfast

09:00 – 09:50 am  Lecture 13: Mechanobiology  
  Roger Kamm, Massachusetts Institute of Technology

10:00 – 10:50 am  Lecture 14: Molecular Imaging Probes  
  Gang Bao, GA Tech

11:00 – 11:50 am  Lecture 15: Mechanics based Microfluidic Devices for Disease Detection and Diagnosis  
  CT Lim, National University of Singapore

12:00 – 01:00 pm  Lunch

AFTERNOON  Biomechanics Labs  
- rotating one-hour demo sessions

Attendees with Last Name: A-G
1:00 – 2:00 pm  Demo: Micropipette Based Technology  
  Venue: Institute of Bioengineering & Bioscience (IBB), 3rd Floor, Lab 3227

2:00 – 3:00 pm  Demo: Embryonic Electroporation  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2104

3:00 – 4:00 pm  Demo: Atomic Force Microscopy  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2402

4:00 – 5:00 pm  Demo: Biomechanics Devices  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2230

Attendees with Last Name: H-M
1:00 – 2:00 pm  Demo: Biomechanics Devices  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2230

2:00 – 3:00 pm  Demo: Micropipette Based Technology  
  Venue: Institute of Bioengineering & Bioscience (IBB), 3rd Floor, Lab 3227

3:00 – 4:00 pm  Demo: Embryonic Electroporation  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2104

4:00 – 5:00 pm  Demo: Atomic Force Microscopy  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2402

Attendees with Last Name: N-S
1:00 – 2:00 pm  Demo: Atomic Force Microscopy  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2402

2:00 – 3:00 pm  Demo: Biomechanics Devices  
  Venue: Institute of Bioengineering & Bioscience (IBB), 2nd Floor, Lab 2230

3:00 – 4:00 pm  Demo: Micropipette Based Technology  
  Venue: Institute of Bioengineering & Bioscience (IBB), 3rd Floor, Lab 3227
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<tr>
<td>1:00 – 2:00 pm</td>
<td>Demo: Embryonic Electroporation</td>
<td>Institute of Bioengineering &amp; Bioscience (IBB), 2&lt;sup&gt;nd&lt;/sup&gt; Floor, Lab 2104</td>
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<td>2:00 – 3:00 pm</td>
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<td>Institute of Bioengineering &amp; Bioscience (IBB), 3&lt;sup&gt;rd&lt;/sup&gt; Floor, Lab 3227</td>
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Saturday, June 25 – Enabling Technologies

Lecture Venue: Marcus Nanotechnology Building, Room 116-118

08:30 – 09:00 am  Breakfast

09:00 – 09:50 am  Lecture 16:  Microfabrication  
Rashid Bashir, University of Illinois at Urbana-Champaign

10:00 – 10:50 am  Lecture 17:  Materials for Drug Delivery and Molecular Imaging  
Niren Murthy, GA Tech

11:00 – 11:30 am  Lecture 18:  Advances in 3-D Cellular and Tissue Imaging  
Peter So, Massachusetts Institute of Technology

11:30 – 12:00 pm  Lecture 19:  Molecular Engineering and Live Cell Imaging for Mechanobiology  
Peter Wang, University of Illinois at Urbana-Champaign

12:00 – 01:00 pm  Lunch

01:00 – 01:50 pm  Lecture 20:  Special Lecture, An Integrative Systems View of Microvascular Network Adaptation  
Thomas Skalak, University of Virginia

02:00 – 02:50 pm  Lecture 21:  Special Lecture, Engineering Therapies for Neural Tissue Regeneration  
Christine Schmidt, University of Texas

03:00 – 03:50 pm  Lecture 22:  Special Lecture, Strategies and Challenges in Control of Wound Scar Formation  
Raphael Lee, University of Chicago

04:00 – 04:50 pm  Lecture 23:  Chemomechanics at the Cell-Matrix Interface: Effects on Cell Contractile Machinery  
Krystyn Van Vliet, Massachusetts Institute of Technology

Sunday, June 26
NO GEM4 PROGRAM SCHEDULED

Monday, June 27
NO GEM4 PROGRAM SCHEDULED
05:00 – 06:00 pm  EBICS Keynote Lecture: Ethics (GEM4 Trainees invited)  
Paul Root Wolpe, Emory University  
Georgia Tech Global Distance Learning Center, Technology Square
**Tuesday, June 28 – Cellular Machines**

**Lecture Venue:** *Institute of Bioengineering and Bioscience, Room 1128*

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| 09:00 – 09:50 am | Lecture 24: *Synthetic Biology: From Parts to Modules to Systems*  
Ron Weiss, Massachusetts Institute of Technology |
| 10:00 – 10:50 am | Lecture 25: *Enabling Technologies in Neurobiology*  
Martha Gillette, University of Illinois at Urbana-Champaign |
| 11:00 – 11:50 am | Lecture 26: *Micro-Mechanical Guidance for Cells Towards Biological Machines*  
Taher Saif, University of Illinois at Urbana-Champaign |
| 12:00 – 01:00 pm | Lunch                                                               |
| 01:00 – 05:00 pm | Microfabrication Lab  
- Clean room basics  
- Microfabrication  
- Characterization |

**Venue:** *Institute of Bioengineering & Bioscience (IBB), Room 1128*
Wednesday, June 29 – Biomaterials

**Lecture Venue:** Marcus Nanotechnology Building, Room 116-118

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| 09:00 – 09:50 am    | Lecture 27: Biomaterials Delivery Systems  
*Nick Willett, GA Tech* |
| 10:00 – 10:50 am    | Lecture 28: Physical and Mechanical Properties of Biomaterials and Their Role in Endogenous Tissue Engineering  
*Rene Olivares-Navarrete, GA Tech* |
| 11:00 – 11:50 am    | Lecture 29: Nanofluidics and Nanopatterning for Single Cell Studies and Drug Delivery  
*Horacio Espinosa, Northwestern University* |
| 12:00 – 01:00 pm    | Lunch                                                                   |
| 01:00 – 01:50 pm    | Lecture 30: Clinical Applications of Microfluidics  
*Wilbur Lam, Emory University/Children’s Healthcare of Atlanta* |
| 02:00 – 02:50 pm    | Lecture 31: Responsive (Bio)Materials  
*Andrew Lyon, GA Tech* |
| 03:00 – 03:50 pm    | Lecture 32: Exploring the Cell-Extracellular Matrix Mechanical Niche  
*Tom Barker, GA Tech* |
| 04:00 – 04:50 pm    | Lecture 33: Biomaterials as Agonists of Biological Responses  
*Julie Babensee, GA Tech* |
Thursday, June 30 – Modeling/Epigenetics

Lecture Venue: Marcus Nanotechnology Building, Room 116-118

08:30 – 09:00 am  Breakfast

09:00 – 09:50 am  Lecture 34: Methods for Modeling Intracellular Signal Transduction
       Melissa Kemp, GA Tech

10:00 – 10:50 am  Lecture 35: Modeling Cell Controlled Extracellular Events
       Manu Platt, GA Tech

11:00 – 11:50 am  Lecture 36: Epigenetics and Stem Cells
       Yuhong Fan, GA Tech

12:00 – 01:00 pm  Lunch

01:00 – 03:00 pm  Ethics Discussions
       April Dworetz, Emory University
       Maryam Doroudi, Emory University

3:00 – 04:00 pm  Summer School Awards and BBQ on the Quad of the BioComplex
       Outside of Institute for Bioengineering and Bioscience (IBB)