

# Summer School on Molecular Mechanics and Enabling Technologies

**Report by: Umer Hassan  
Lab Engineer  
SSE, LUMS**

Global Enterprise for Micro-Mechanics and Molecular Medicine (GEM4), together with National Science Foundation (NSF), conducted a summer school from 8-19 June, 2009 at the University of Illinois at Urbana Champaign (UIUC), USA. The school was based on “Cellular and Molecular Mechanics with a focus on Enabling Technologies”. Cellular and molecular mechanics deal with the study of the biological systems at the micro scale.

I was awarded a fellowship to participate in the summer school by the NSF. The School was co-sponsored by various research centers on the campus such as the Micro and Nanotechnology Laboratory (MNTL), Center for Nanoscale Science and Technology (CNST), Center for Cellular Mechanics (CCM), Siteman Center for Cancer Nanotechnology Excellence, College of Veterinary medicine, and the Department of Mechanical Science and Engineering (MechSE). The organizing committee comprised Dr. Jimmy Hsia (MechSE), Dr. Rashid Bashir (ECE), Dr. Irfan Ahmad (CNST), and Dr. Taher Saif (MechSE), some of which are eminent Pakistani scientists.



Figure: Organizing Committee (L2R: Taher Saif, Roger Kamm, Jimmy Hsia, Irfan Ahmad, and Rashid Bashir)

There were about 45 participants, most of them were graduate students and young faculty members of various Universities from around the world. Most of them came from an engineering background (electrical and mechanical engineering), but there was also a sizeable number hailing from diverse fields such as cellular biology, biochemistry, and physical chemistry. They represented countries such as Pakistan, Japan, Singapore, Spain, Switzerland, Iran and USA.

The Summer School was studied by a series of stunning lectures given by distinguished professors from around the world including MIT, Stanford U, GaTech, Illinois, U Washington, U Penn, UT Austin, Harvard Medical School, National University of Singapore and the Max Planck Institute.

Summer school started with the welcome address by Ilesanmi Adesida, Dean of Engineering, UIUC. Then Chair of Organizing committee Dr Hsia welcomed the participants and gave an introduction to the GEM4 team. He also introduced to the participants the cultural diversity of the summer school. Then the other organizing committee members told us about their respective research centers. I felt pride knowing that some of them were from Pakistan.

The most exciting feature of the Summer School was the organization of hands' on experimental laboratory modules. These breath-taking sessions provided me highly informed first exposure to the latest technologies in the fields of nanotechnology and cell biology. I worked on instruments such as electron microscopes and photolithography systems, machines I could only dream of. Purifying DNA and seeing the green fluorescent live cells filled me with so much enthusiasm and fervor which resulted in deriving me to pursue more interdisciplinary research in my later life.

The hands on laboratory modules consisted of four parts. The **Micro and Nano fabrication lab** was held in the 1000 clean room technology in which I did lithography, dry etching, thin film deposition, and soft lithography (a micro fabrication technique used to make integrated circuits). The **Enabling Technology lab** was focused on Polydimethylsiloxane (PDMS) device fabrication. It is a widely used silicon based organic polymer used in many applications ranging from medical devices to lubricating oils. I also performed Neutrophil chemotaxis and cell capture in bio-chips, this all provided me the first exposure to micro-fabrication. In the **Cellular Biology lab** module I started with learning Aseptic techniques, then performed the mammalian cell culture and finally transfected the cells with green fluorescent proteins while working in the Biosafety hazard level 2. In **Molecular Biology lab** module I purified the DNA and then studied the Polymerase Chain Reaction (PCR). All these lab modules provided me the introduction to the cutting edge research being carried out in the research community which helped me to foster my research interests in diverse fields.



Figure: Working in clean room

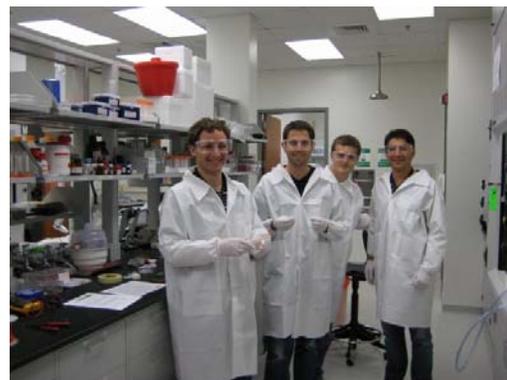


Figure: Enabling Technology Lab

Everyday, before lunch-time, I listened to three lectures on various topics of cellular and molecular mechanics. Interestingly, I always try to correlate my existing electrical engineering knowledge with biology during the lectures. This clearly shows that boundaries between the sciences are slowly diffusing away. The lectures also gave me a

stark reminder of my own ignorance and limited knowledge in the furiously expanding arenas of science. All the lectures always ended with informative and thought provoking question and answer sessions.

During the intermittent coffee breaks and the mid-day lunch intermission, I usually interacted with the speakers to know more about their research. In one of the meetings, I suggested the speaker some improvements in the research results he obtained, he appreciated my comments and offered me to work with him.



Figure: Morning lecture

At the end of the first week, we had a picture taking ceremony. I took so many pictures of the participants and with the organizers. Finally, the group photograph was taken outside the MNTL. The background building in the picture is Micro and Nanotechnology Laboratory.



Figure: Group Photo of GEM4 summer school

We had a poster session or competition on the end of first week. All the participants have prepared very good posters elaborating their research. My poster explained artificial neural networks and its wide range of applications. Six judges had judged the posters and finally gave the three best poster nominations.

As an offer of respite from work, the organizers arranged a trip of the school to Chicago, where I visited Sears Tower, Millennium Park and Michigan Lake. I had a very great weekend.

After a graduation ceremony, I took more pictures, thanked the School organizers and said goodbye to all my new friends with the promise that I always stay in touch with them. Two weeks ended very soon, I enjoyed a lot, learned so many new things, interacted with so many different people of different cultures and countries, and made new friends. I took all happy memories with me back to Pakistan.