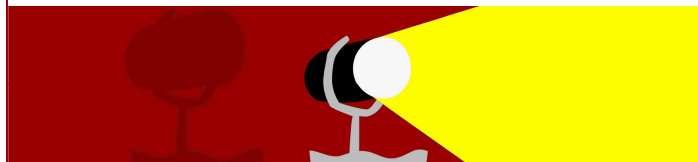


The Scope

Volume 1, Issue 1

Fall 2006

In • the • Spotlight



Robet Tilton

Professor, BME and Chemical Engineering

He and collaborators Greg Lowry (Civil and Environmental Engineering), Kris Matyjaszewski (Chemistry) and Ned Minkley (Biological Sciences) have been awarded a \$1.075M Nanoscale Interdisciplinary Research Team (NIRT) grant by the National Science Foundation. The team is developing a system of block copolymer-functionalized iron nanoparticles to provide efficient source-zone remediation of aquifers that have been polluted by industrial solvents.

Rui Zhao

Ph.D. candidate, 2nd year, Advisor: Dr. Jim Antaki

Rui received second place in the Doctoral Level Podium Competition, in the technical area of "Biofluid and Imaging" at this year's American Society of Mechanical Engineers held in Amelia Island, FL.

<http://divisions.asme.org/bed/events/summer06.html>

Spotlight, continued on page 7

A Letter from the BME Department Head

Professor Todd Pryzbycien

Head of the Department of BME, CMU

Welcome to Volume No. 1, Issue No. 1 of The Scope, a newsletter describing the latest happenings within the Biomedical Engineering Department (BME) at Carnegie Mellon. This newsletter is a joint production of the Graduate Biomedical Engineering Society (GBMES) and the Department of Biomedical Engineering.

This is an exciting time for BME at Carnegie Mellon. We have undergone steady growth in the size of our faculty and our student bodies since our beginning as a Department in 2002 – and it's time to spread the news about our activities and achievements. Two new faculty members will be joining us this coming January, Drs. Kerem Pekkan and Gustavo Rohde. Kerem will be joining us from Georgia Tech's Biomedical Engineering Department, where he holds a research faculty position;

(Continued on next page)

A Letter from the GBMES President

Sanna Gaspard, M.S.

Ph.D. candidate, 3rd year, Advisor: Dr. Jim Antaki

The Graduate Biomedical Engineering Society (GBMES) was founded in October 2005 to promote comradery between BME graduate students, to provide academic and student-life resources to its members, and to build a positive relationship between students, faculty, and industry. GBMES strives to be both a social and a professional liaison for its members. GBMES sponsors several social activities throughout the year to give our members a chance to interact; including monthly happy hours, bowling nights, a Christmas party, and Casino Night, just to name a few. As a professional liaison, GBMES strives to initiate change within the Biomedical Engineering Department by

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GBMES EXECUTIVE BOARD

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(Letter from BME Department Head, continued from page 1)

his interests lie in cardiovascular mechanics and surgical planning. Gustavo is completing an NRC postdoctoral position at the Naval Research Laboratory; his expertise is in sub-pixel image processing. Kerem and Gustavo will join our recently hired colleagues, Prof. Zapanta (cardiovascular mechanics) who joined us this past June, Profs. Kris Dahl (cellular biomechanics) and Stefan Zappe (bioimaging and bioMEMS) who joined us this past January and Prof. Newell Washburn (biomaterials) who joined us in September 2004. These new faculty members bolster our research and teaching strengths

in bioimaging, biomechanics, biomaterials and cellular and molecular biotechnology.

Our graduate student body is expanding steadily from the 13 hardy souls who joined us in Fall 2002. We now stand at 32 graduate students strong including the 7 students who joined us this Fall - welcome aboard Sasha, Beautia, Chris, Usha, Davneet, Scott and Peng! This growth has energized the GBMES; we very much look forward to the Second Annual GBMES Research Symposium this coming spring.

Finally, our second generation undergraduate dual major curriculum rolled out with the Class of 2009. At the sharp edge of this new curriculum are Prof. Zapanta and teaching assistants Justin Newberg and Warren Ruder, who have rolled up their sleeves along side 23 members of the sophomore class to launch the new 42-203 BME Laboratory course. This sophomore class together with the juniors and seniors comprise over 180 undergraduates who have declared the BME dual major.

We look forward to keeping you apprised of our progress and successes.

New Faculty Focus

Dr. Stefan Zappe

Assistant Professor, Department of BME, CMU



I was born and raised in Wolfenbüttel, a small town in the northern, flat part of Germany. Wolfenbüttel is known for *Jägermeister*- an herbal liquor that doesn't make it on your top ten list of drinks when you grow up and start partying with your friends- and, of course, for Gotthold Ephraim Lessing who wrote his famous play,

"Nathan the Wise," there, while taking care of the local Herzog August library.

In part because of troubled past-war times, both my parents had to quit school at the age of fourteen to pick up jobs, and I did not exactly grow up with the idea of one day pursuing an academic career. It was actually my brother Thomas, four years older, who always seemed more predestined for a life in science. He would know everything about animals and would happily bring home and study whatever creature he could find: lizards, tadpoles, frogs, snakes, little sticklebacks, hedgehogs.

Later on however, he decided to become a police officer, and today he raises his own family close to my parents' home. Meanwhile, I entered academia and began to travel half way around the globe in a quest for academic excellence and eternal glory.

The first stop on this adventurous journey was Braunschweig, a city slightly bigger than Wolfenbüttel and approximately ten miles away. I began my undergraduate studies of Electrical Engineering at Braunschweig University of Technology, but I was not

impressed with their teaching approach: they just made us practice specific types of problems so that we would be able to solve enough of them in a given time during the exam. Lacking an understanding of the bigger picture, I lost interest and worked as little as necessary just to pass exams. I joined a drama group instead, and we even performed at the Cité Universitaire in Paris. There were clearly more people on stage than in the audience, but we had a great time. I also played saxophone in a Big Band, but I don't recall that my amazing musical talents were ever fully appreciated.

Instead of finishing my studies with a Diploma thesis at Braunschweig, I anticipated the upcoming change, moved to Berlin, finished my undergraduate studies at Berlin University of Technology and joined as a Ph.D. candidate the laboratory of Professor Ernst Obermeier, one of the world-pioneers of MEMS technologies. There was no rational reason for this early change - I guess I just had to escape all-too-familiar ground for the sake of my personal development.

Research in Germany is partly sponsored at the national level and partly at the European level. I had the chance to join a research program sponsored by the European Union. In collaboration with partners in Germany, England, France and Greece, I worked as a

"I take it as a challenge to contribute to the success of Carnegie Mellon in general and the young BME Department in particular."

Ph.D. candidate on the establishment of a novel material system based on the wide bandgap semiconductor silicon carbide, and I developed high-temperature-capable pressure microsensors based on that system. I very much enjoyed our project meetings, for example on the beautiful Chalkidiki peninsula of Greece and in wonderful Paris.

The deep insight into MEMS activities at universities and companies across Europe helped me to join Professor Olav Solgaard's group at Stanford as a postdoctoral researcher after graduation. I remember standing on the Golden Gate Bridge on a sunny afternoon after visiting Olav for an interview, watching all the sailing boats with their colorful spinnakers on the San Francisco Bay, and strongly feeling that this

was the place where I wanted to be.

Olav's research is mainly focused on optical MEMS. SONY, for example, ended up acquiring the IP for the Grating Light Valve display technology that he co-invented, and it is quite entertaining to experience a home theater based on that technology in the SONY showrooms in Tokyo.

When I joined Olav's group, I started working on a DARPA-sponsored program called "Bio-Info-Micro" that aimed at bringing together researchers from biology, informatics and microsystem technologies to let them work jointly on a biological project. We teamed up with Professor Matthew Scott at Stanford, a geneticist and developmental biologist who works with the fruit fly *Drosophila melanogaster* as a model system for human development and disease. I developed automated, MEMS-based injection technologies in support of high-throughput *Drosophila* embryo RNAi screens. RNA interference or RNAi refers to a mechanism that allows for silencing of a specific gene inside a cell or – in our case – an entire embryo. An observed change in phenotype indicates the function of the silenced gene.

I liked biology in high school, but I completely forgot about it ever since. When I came to Stanford, I was just amazed by the exciting research that was going on - a "feast of discoveries," as Matt Scott would put it.

Living close to Stanford in the heart of the Silicon Valley is an amazing experience for other reasons as well. You suddenly feel that you have eventually found the nest of all the hightech and biotech companies that are so well known around the world like HP, Agilent, SUN Microsystems, Google, Yahoo, Intel, Genentech, Applied Biosystems and so on. You also meet so many prominent people, for example Google's co-founder Larry Page who at times comes in on rollerblades to Bioinformatics conferences at Stanford. Or Sydney Brenner, one of the founding fathers of modern biology, who is truly inspiring when he visits and talks about biology with all his great sense of humor.

My Stanford experience raised my desire to continue research at the interface of technology and biology. When I interviewed at Carnegie Mellon, I immediately had the impression that this place would ideally support my interdisciplinary research ambitions while

allowing me to step deeper into biology. My achieved colleagues, the motivated staff members and all the talented students that I have met so far at Carnegie Mellon impress me a lot. I take it as a challenge to contribute to the success of Carnegie Mellon in general and the young BME Department in particular. A very important part is certainly the creation of a productive research environment that will offer students a joyful and inspiring research experience and will help them to prepare for leadership positions in academia and industry. I hope that- over the years- I will manage to come at least close to the most creative researchers and educators that I have met in my career so far.

Dr. Zappe's faculty website can be found at:

<http://www.cmu.edu/bme/faculty/zappe.html>

Dr. Kris Dahl

Assistant Professor, Department of BME, CMU



Dr. Dahl comes to Carnegie Mellon with a Ph.D. in Chemical and Biomolecular Engineering from the University of Pennsylvania, and a post-doctoral degree from the Johns Hopkins University School of Medicine. She has appointments in Biomedical and Chemical

Engineering, and is a core faculty member of the Center for Bioimage Informatics. This fall, we sat down with Dr. Dahl and asked her a few hard hitting questions:

How does your work relate to the focuses of the BME department?

I feel that our work merges the fields of biomechanics, biophysics, traditional cell and molecular biology, biomaterials and biological imaging. We use traditional optical techniques - and utilize the advanced optical techniques of the department - along with biophysics techniques developed in our lab to measure biomechanical properties of subcellular organelles and networks. To get good control of the systems requires a tight control of the cell biology and molecular manipulation of the system as well as using biomaterials for cell control. I really consider our

research to be "bridging" research. We don't really focus on any one particular pillar of the department but we cross over many of the pillars. I find it very exciting to do unique research but be able to integrate with the tremendous talent in the BME department.

And where does your research fit into "the greater picture"?

Typically, our work is of interest to biomedical engineers and biophysicists, obviously. However, we are also trying hard to market our work cell biologists. We are working to shift the paradigm to make cell biology include mechanics, force, stress and strain in examining cell behavior. Cell biology is such an amazingly talented, complex and well-established field already, so it is difficult to add new techniques and ways of thinking that are not as well established or controlled. With our hard work we have been able to make strides in showing the importance of the stiffness of biological networks and have published our works in Journal of Cell Science and Proceedings of the National Academy of Sciences as well as being recognized by the American Society of Cell Biology in the Press Book.

What attracted you to academic research? To Carnegie Mellon University?

I chose to be a professor because I love bringing together ideas and doing great things that are important to the world but may not necessarily turn a profit for a company. I also really enjoy teaching and the youthful aspect of a university. I chose Carnegie Mellon because the work I do is very cross-disciplinary, and I realize that I can't learn everything. I needed to work at a university where I would be able to collaborate with the best minds in the best facilities where people would be open and sharing... and it wouldn't hurt my career. Carnegie Mellon is the perfect example of such a place.

Dr. Dahl's faculty website can be found at:

<http://www.cmu.edu/bme/faculty/dahl.html>

Dr. Conrad Zapanta

Associate Teaching Professor, Department of BME, CMU

I am an Associate Teaching Professor of Biomedical Engineering. I started working here in June. My primary responsibility is to develop laboratory classes

for undergraduates in the Department of Biomedical Engineering. My additional teaching interests include medical device design education and the further alignment of the biomedical engineering curriculum to meet ABET (Accreditation Board for Engineering and Technology) criteria. My research interests are in developing medical devices to treat cardiovascular disease, focusing on the areas of cardiac assist devices and prosthetic heart valves.



The story of how I ended up (back) at Carnegie Mellon starts during my senior year of high school.

It was time to look for a college, and a flier came in the mail from some place called Carnegie Mellon. I had never heard of the school, but my guidance counselor said it was a good school and that I should apply. I was accepted, and fell in love with the school during my campus visit. I became the average Carnegie Mellon student (for better or worse) and eventually received my BS in Mechanical Engineering with an Option in Biomedical Engineering. Not surprisingly, Hilda Diamond provided career advice and helped me find research opportunities during my undergraduate years. Other highlights during my first stint at Carnegie Mellon include pushing buggy and meeting my future wife (who happened to be the driver of the buggy that I pushed).

I then moved on to graduate school at the Pennsylvania State University in the Department of Bioengineering. My dissertation correlated prosthetic heart valve dynamics with cavitation through both *in vitro* and *in vivo* studies. This work involved working with the artificial heart groups at both the University Park and College of Medicine (Hershey, PA) locations.

While I was finishing my dissertation, I moved on to Hope College (Holland, MI) to serve as an Visiting Assistant Professor of Engineering. It was here that I discovered my passion for teaching. However, I realized that I needed to get real-world experience so that I could better prepare students for life after college.

I moved on to CarboMedics, Inc. (Austin, TX) where I

oversaw testing of prosthetic heart valves for research and development. To keep my teaching bug satisfied, I did training sessions for visiting surgeons and taught a mechanical engineering class at the local community college. I was expecting to stay in Texas for a very long time (for the food, if nothing else) when life happened. My wife and I started a family, and we realized that we didn't like being so far away from our families.

We decided to move back north and eventually came back to the Pennsylvania State University. I worked as an Assistant Professor of Surgery and Bioengineering at the College of Medicine. This was my "first homecoming," as I was back with many of the people whom with I previously worked during graduate school. I had the opportunity to develop artificial hearts for small adults and children. My research was focused on developing novel blood contacting surfaces to

"I love being back on campus for my 'second homecoming.'"

minimize the thromboembolic complications that are typically associated with cardiac assist devices using micro-fabrication techniques. I also did research in determining the effect of cardiac arrhythmias on prosthetic heart valve function and developing artificial hearts for smaller adults and children. While I loved the people and work at Penn State, I eventually realized that I didn't want to spend the rest of my life worrying about grants. I also discovered that my teaching opportunities were very limited, as I only taught one class (Artificial Organ Design) every other year.

While taking a break from putting together a grant application, I ran across an ad from Carnegie Mellon for a teaching position in Biomedical Engineering. On a whim, I decided to apply for the job. Much to my surprise, I got an interview and eventually an offer. I love being back on campus for my "second homecoming." Once I get settled with classes, I plan on getting involved with the artificial heart research both here at Carnegie Mellon and the University of Pittsburgh.

In closing, I'm living proof that it is possible to come home (again). It just took me some time to find my way back!

New Student Focus

Sasha Bakhru

M.S.E., Johns Hopkins University, Baltimore, 2006



I was born and raised in Albany, New York. I spent my undergraduate years at Columbia University in New York City, majoring in biomedical engineering and minoring in mechanical engineering. I then

moved to Johns Hopkins University in Baltimore, Maryland where I completed a masters degree in materials science and engineering, with a concentration in biomaterials. At CMU, I will study under Professor Stefan Zappe. My research interests include engineering polymer-based microstructures for stem cell culture, as well as bioMEMS design and fabrication.

Beautia Dew

B.E., Cooper Union, New York, 2004

I graduated from the Cooper Union with a B.E. in chemical engineering in 2004. Then I worked at the NYC Department of Environmental Protection. I will be working for Professor Robert Tilton and Professor Todd Przybycien. I will be studying the interactions of PEGylated proteins and PLG microspheres.

Christopher Highley

B.S.E., Duke University, Durham, 2004



I'm from Richmond, Virginia and received a BSE in Biomedical Engineering with a second major in German from Duke in 2004. Outside of school I have worked in a small software company and at MIT's Langer Lab, where my

research focused on wound healing and drug delivery. I'm excited to work with Dr. Elena DiMartino on soft-tissue simulations with the aim of exploring cardiovascular injury. Outside of school, I love to row and travel whenever possible.

Davneet Minhas

B.S., Johns Hopkins University, Baltimore, 2006

Davneet Singh Minhas graduated from Johns Hopkins University with a bachelors degree in biomedical

engineering in 2006. He minored in film and video games. Davneet is developing a minimally invasive steerable needle for the treatment of tumors and other intraparynchymal disorders of the brain under Dr. Cameron Riviere. His passions include online poker, World of Warcraft, pool, basketball, and Home Improvement.

Scott Parsons

B.S., Rensselaer Polytechnic Institute, New York, 2004



I was raised in upstate NY and went to Troy, NY to attend Rensselaer Polytechnic Institute. I majored in biomedical engineering with a concentration in biomaterials. I worked there under Dr. Jan Stegemann to

develop tissue-engineered vascular constructs and made a bioreactor to help grow and feed these constructs. At Carnegie Mellon, I will be working with Dr. Kris Noel Dahl and Dr. Mohammed Islam in applying nanotube gels as a viable scaffold for tissue-engineered materials. I am fascinated by the potential that carbon nanotubes have in this field. Last year I taught chemistry to high school students and the year before that I worked for the NYS Dept. of Health as a lab manager/technician. I am married and have a pug.

Tao Peng

B.S., Tsinghua University, Beijing, 2006



I am from mainland China. I got my bachelor degree in Tsinghua University, Beijing. My advisor is Dr. Robert Murphy. I'm interested in the area of medical image processing and analysis, and signal processing. In my free time

I enjoy billiards.

Usha Kuppswamy

B.S., R.V. College of Engineering, Bangalore, India, 2004

I was born and raised in Bangalore, India. I chose a career in engineering when I recognized my abiding interest in, and flair for, the sciences. I received my BS degree in Electronics and Communication from R.V. College of Engineering, Bangalore. At the graduate level at Carnegie Mellon University, I seek to pursue research in bionanotechnology, Biosensors and



bioMEMS, - areas with wide-ranging applications in disease diagnosis, physiological sensing, drug delivery, and tissue engineering. I will be working with Dr. Stefan Frank Zappe.

Spotlight, continued from page 1

Amina Chebira

Ph.D. candidate, 3rd year, Advisor: Dr. Jelena Kovacevic

Amina recently won the 2006 Department of Biomedical Engineering Best Teaching Assistant Award for TAing "Advanced Bioimaging" and "Bioimaging."

Ariel Drummond

Ph.D. candidate, 3rd year, Advisor: Dr. Jim Antaki

Ariel participated in the NSF East Asia and Pacific Summer Institute for Graduate Students where she worked for 2 months working at Seoul National University in the Laboratory for Rheology & Processing of Microstructured Materials.

Paul Glass

Ph.D. candidate, 2nd year, Advisor: Dr. Elena DiMartino

Paul won the CMU Dowd Fellowship for his proposal entitled, "Improving the Diagnosis and Treatment of Small Intestine Diseases with Pill-Sized Robots." <http://www.ices.cmu.edu/dowd/>

Phil LeDuc

Assistant Professor, BME, MechE, Biological Sciences

Phil won the 2006 Carnegie Institute of Technology George Tallman Ladd Research Award.

Courtney Ondeck

Undergraduate, Junior, BME and Materials Science

Courtney has been awarded the Pittsburgh Foundation Joseph F. and Louisa A. Mulach Scholarship.

Newell Washburn,

Assistant Professor, BME and Chemistry

Newell has received a 3M Nontenured Faculty Award to support his basic research on biointeractive polymers for wound healing.

(Letter from GBMES President, continued from page 1)

translating graduate student opinion into action. To this end, GBMES has initiated a Grad BME Departmental Evaluation and has pushed for the incorporation of an amendment procedure to Grad Review Process. In addition, we published this departmental newsletter and hosted the first annual Carnegie Mellon Research Symposium on April 20, 2006. The symposium- where graduate and undergraduate research within the BME department was highlighted to the Carnegie Mellon and greater Pittsburgh communities- was a success, and we look forward to hosting it again in April 2007.

Graduate Affairs Committee (GAC)

Written by Professor Jelena Kovačević

The GAC was established in 2005 to handle all issues related to the BME graduate student body. These include admissions, curriculum, M.S./Ph.D. requirements including Ph.D. Quals, Ph.D. Proposals and Ph.D. Theses, Grad Review, fellowships and scholarships, conflict resolution, and any other issues related to graduate students.

The current GAC members are: Jelena Kovačević (Chair, jelenak@cmu.edu), Todd Przybycien (todd@andrew.cmu.edu), Robert Tilton (tilton@andrew.cmu.edu) and Newell Washburn (washburn@andrew.cmu.edu). The GAC can be contacted via bme-gac@cmu.edu.

Several past and current projects include:

New graduate curriculum. The new curriculum introduced a core of courses, to be taken within the first three semesters in residence (summer counts as a semester) to establish a common knowledge base for our BME graduates. The core requirement is complemented by a course requirement.

New quals procedures. The Ph.D. Quals are to be taken within the first three semesters in residence. The student writes a 10-page paper and presents it in front of a 4-member BME committee. The purpose of the exam is to assess the student's potential as an independent researcher and not as a critique of the particular project; the project critique is the objective of the proposal exam.

Introduction of the Grad Review. The Grad Review has been established to track the student's progress and provide timely and constructive feedback on the research topic. It started in the Spring of 2006 and is conducted at the end of each semester. The student's case is presented by his/her advisor, together with the self-assessment letter from the student and input from the faculty body. The outcome is a feedback letter from the faculty to the student. We are currently instituting procedures for students to offer a rebuttal to the faculty feedback.

Web. The GAC has established a web-based application process, a student web repository and the web-enabled grad review process. These are all in progress. The GAC web site is also in the works. The goal of this project is to have the full student record on the web, which can be accessed both by faculty and the individual student.

Policies for conflict resolution. The GAC is in the process of establishing procedures for conflict management and resolution. Until those procedures are in place, we invite students to contact the GAC Chair with any problems.

Additional people to contact for support are Nancy Klancher (klancher@andrew.cmu.edu) and Suzie McIntyre (suzannel@andrew.cmu.edu).

Graduate Student Review

Written by Professor Jelena Kovačević

The Grad Review has been established to track the student's progress and provide timely and constructive feedback on the research topic. It started in the Spring of 2006 and is conducted at the end of each semester. We stress that the Grad Review process is a positive, constructive process allowing faculty to be in touch with the entire graduate student body and the students to receive feedback in a timely manner.

The material presented at the Grad Review consists of: self-assessment written by the student, one-slide presentation by the advisor and the draft feedback letter read by the advisor. The feedback letter from the previous semester is read as well. This is followed by a discussion by the entire faculty resulting in a letter grade (SP, USP, N-1, M2M) as well as written feedback. The first-semester students receive a letter but not a grade.

The grades are as follows:

The **grade of SP** (satisfactory progress) states that the faculty body is satisfied with the student's progress. The feedback letter gives pointers (if any) for specific steps to be taken to help the student's research.

The **grade of USP** (unsatisfactory progress) states that the faculty body expressed concerns over some areas of student's performance. These will be spelled out in the feedback letter. Typically, the status of USP is converted to SP in the following semester, given satisfactory progress.

The **grade of N-1** (support not continued past next semester) is given in rare circumstances where the faculty body expressed deep concern over student's performance. The feedback letter in that case will state specific milestones which must be met for the grade of N-1 to be converted to SP in the following semester. If those milestones are not met, the student's support is terminated at the end of that semester.

The **grade of M2M** (support not continued past next month) is given in rare circumstances where the faculty body expressed grave concern over student's performance. The feedback letter in that case will state specific milestones which must be met for the support to continue past the following month.

The outcome of the Grad Review is a feedback letter from the faculty to the student. We are currently instituting procedures for students to offer a rebuttal to the faculty feedback.

EVENTS & NOTES

GENERAL BODY MEETING, NOVEMBER 29TH

PLACE: DOHERTY HALL A310 TIME: 5-8 PM

HAPPY HOUR, DECEMBER 1ST

PLACE: TO BE ANNOUNCED TIME: TO BE ANNOUNCED

POTLUCK CHRISTMAS PARTY, DECEMBER 9TH

PLACE: ELVIRA'S (IN SHADYSIDE) TIME: 6-9 PM

- Don't forget to check out BME department seminars at <http://www.cmu.edu/bme/about/seminar.html>
- The second annual GBMES symposium will held April 19th, 2006. It's not too early to start preparing a talk or poster.
- There will be a departmental holiday dinner and raffle. Date, time and location TBA.
- For additional information, please check out:

<http://www.andrew.cmu.edu/org/gbmes/>