Newsletter

College of Physical and Mathematical Sciences

June/July 2006

In the months of: June/July

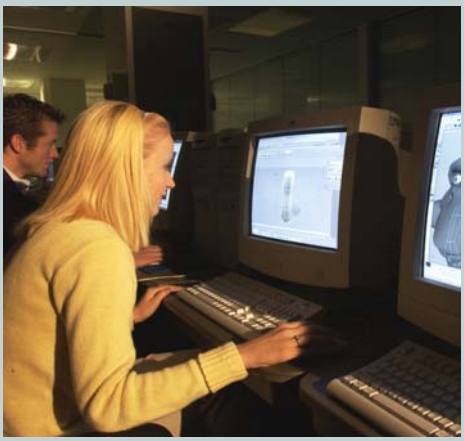
- 6./19-Last day of class, spring term
- 6/26-First day of class, summer term
- 7/4-Holiday, Independence Day
- 7/11-Devotional, Joann Abegglen
- 7/18-Forum, Dan Judd
- 7/24-Holiday, Pioneer Day
- 7/25-Devotional, Bill Baker

In this issue:

Department Creates Student Resume Database

Department of Computer Science

The Department of Computer Science announces the creation of a new employment tool: a student resume database that will facilitate student-employer interaction. The database will be used as a show piece in order to attract prestigious companies to recruit at BYU. It will also allow students an opportunity to be noticed as the department visits companies and promotes external relations. The first 50 students who upload their resume will receive free Creamery ice cream. Come to 3361 TMCB to redeem your coupon.



Computer Science Students doing Research
http://unicomm.byu.edu/about/photos/

Students who wish to upload a resume should click on the "Careers & Employment" link on the homepage and then click "Resume Database." They should then put "Student" as their login type and enter in their BYU NetID and password to gain access. The interface will allow a student to upload their resume and a picture. They will also be able to post a URL for their personal website or projects.

The database will also display the type of work they are looking for and when they will be available to work. The form will ask them to include some of their personal information such as address, phone number, and email. This information will not be viewable by employers unless the student gives their consent. The Department will only approve employers to access the site who have quality employment opportunities available.

Employers who wish to create an account should click on the account link on the resume database login page at https://www.cs.byu.edu/resume. The Department will authorize or reject their account request in less than 24 hours.

USTAR Nominations Announced

June 1, 2006

SALT LAKE CITY – Governor Jon Huntsman, Senate President John Valentine, Speaker of the House Greg Curtis and Commissioner of Higher Education Richard Kendell today announced the nomination of eight members to the newly-formed Utah Science Technology and Research (USTAR) Board today, sending the names to the Utah State Senate for confirmation.

One of our faculty members, Dan Olsen, was one of these nominees.

Dan Olsen

Dan Olsen, Ph.D.

Olsen has been a leader in researching human-robot interaction. He is a professor of computer sciences at Brigham Young University and has worked as the director of the Human Computer Interaction Institute at Carnegie Mellon University. The author of two books and numerous other publications, Olsen is engaged in many professional organizations. He earned a BS and MS in computer science in 1976 and 1978, respectively, from Brigham Young University. He earned his PhD in computer and information science from the University of Pennsylvania in 1981.

BYU professor uses math to understand how scarring works

Department of Mathematics, June 2006

When in utero surgery was being developed in the early 1980s, surgeons were surprised to find that upon birth the treated babies had no scars. Subsequent research revealed a protein present in adults but not in fetuses that scientists believed was responsible for scarring, but they did not understand why.

Brigham Young University mathematician John Dallon develops complex equations and computer models that suggest to biologists how that particular protein causes scarring, giving them a jump-start on the effort to uncover a means of halting that process and avoiding blemishes. He recently published his latest results in the current issue of the journal "Philosophical Transactions of the Royal Society, Series A."

Mathematicians sometimes find themselves caricatured as impenetrable theorists pursuing mysteries many might find irrelevant. But Dallon's work in the burgeoning new discipline of math biology explodes that stereotype.

"What I can do for biologists is say, 'When you design your experiments, these are the places I think you'll find interesting, and these are the predominant effects,'" said Dallon. "The mathematical model can direct experiments, rather than biologists using a shotgun approach and being forced to design an inordinate amount of experiments because they don't know where to begin looking."

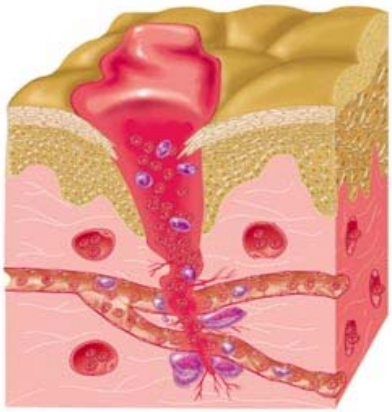
Other applications of math biology, which has grown increasingly over the past decade, include ecology, epidemiology and neural networks, said Dallon.

"The strength of mathematics is uncovering the essential structure governing complex interactions," he said. "Biology is ripe for mathematicians' help -- the biologists can measure so many things and they have so much data. Mathematics can really help by peeling back the irrelevant data and cutting to the core."

Dallon helps biologists by wading through their many observations in an effort to determine which have the most responsibility for scarring. In his latest paper, he examines the introduction of a chemical involved in the scarring process into his mathematical equations. He is joined on the paper by Steve McDougall, Jonathan Sherratt and Philip Maini.

"One of the characteristics of a scar is that the tissue alignment in the scar region is very different from the alignment in normal tissue," said Dallon. "In normal tissue, collagen is 'basket woven' or randomly aligned, but in scars, it is aligned. "That's one reason why scars stand out from the surrounding skin."

Wound researchers need to know which of the many complex interactions involved in wound healing are most responsible for causing alignment and hence, scarring. Working backwards, Dallon makes educated guesses based on previous medical observations as to which factors cause the neat alignment of the collagen. He writes mathematical equations and plugs those factors in -- if the equations yield random solutions, no scarring would occur, meaning the factors are not relevant to the scarring process. But if the equations yield more alignment, that suggests those factors play roles.



"In modeling biology with mathematics, my goal is to understand this very complicated system," said Dallon. "All these interacting pieces -- the blood clots, the inflammatory phase, collagen reformation, wound contraction -- relate with each other. In order to understand exactly what causes tissue to stay aligned, I want to isolate one part in a very simple setting. I want to strip away everything that is not essential and get results to hand over to the biologists for further tests."

Dallon's equations center on the key protein present in adults but not fetuses, known as transforming grown factor beta, or TGF beta. He tests various effects of TGF beta, such as its influence on the speed and direction of the involved cells, to see how they are involved in scarring.

When Dallon's equations consider TGF beta's ability to cause cells to reorient themselves more frequently, the result is more alignment, meaning he has isolated the characteristic that is most responsible for scarring. Now, he said, biologists can focus on influencing this particular effect of TGF beta in hopes of inhibiting scarring but preserving the positive wound healing functions of the protein.

Brigham Young University Mathematics Professor Selected as Fulbright Scholar

Department of Mathematics

BYU Professor, Wayne Barrett

Provo, UT. - Brigham Young University mathematics professor Wayne Barrett has been selected as a Fulbright scholar to Israel for the upcoming academic year. Fulbright scholars are chosen by a presidentially appointed board to enrich the educational, political, economic, social and cultural lives of countries around the world. Barrett brings a commitment to establish open communication and long-term cooperative relationships with Israel.

Professor Barrett has had a distinguished career in the mathematics department at BYU. He served as chair of the department and is a leader in scholarship as well as a popular teacher.

He is a respected researcher who has authored over forty publications while collaborating with 20 mathematicians from around the world. His teaching awards include the Karl G. Maeser Excellence in Teaching Award from Brigham Young University and the Distinguished Teaching Award from the Intermountain Section of the Mathematical Association of America. He is often found tutoring a classroom full of students because his office won't hold them all.

2006 External Grants Awarded to Faculty

July 3, 2006

Faculty	Project Title	Amount Awarded
Barry M Willardson	Physiological Role of Phosducins in the Retina	$219,713
Bryan S Morse	Image Vectorization	$30,000
Delbert J Eatough	Particulate Air Pollution and Health Conference	$7,500
Gregory F Burton	Tissue and Cell Reservoirs for HIV	$171,402
Julie Boerio-Goates	Measurement of Third Law Entropies of Copper Oxychloride	$3,201
Matthew Linford	Research Collaboration with US Synthetics	$8,000
Michael Dorff	Mathematics Scholarships at Brigham Young University	$52,722
Milton Lee	Real-Time Detector System Development and Validation	$39,500
Paul Savage	Development of Improved Antagonists for iNKT Cells	$100,000

BYU experts unravel 'G proteins'

By Lois M. Collins
Deseret Morning News

June 1, 2006

BYU researchers have unraveled the mystery of certain proteins involved in everything from heart rate to brain function and cancer growth.

Researchers Georgi Lukov, left, and Barry Willardson found the mechanism for assembly of G proteins.

The scientists discovered the mechanism for the assembly of G proteins, which are involved in cell signaling and are essential for responses to hormones, neurotrasmitters and more, said lead investigator Barry Willardson, associate professor of biochemistry at Brigham Young University. The findings are published today in the Journal of the European Molecular Biology Organization.

G proteins are a complex of three different subunits — alpha, beta and gamma. Beta and gamma "fold" together to activate enzymes and ion channels in the cells. The BYU research explains how those two subunits associate.

The G protein-coupled receptors on the surface of cells are the biggest class of receptors in the human genome, Willardson said. About half of all pharmaceuticals are targeted to these receptors. People who take beta blockers for heart disease, Prozac for depression, Claritin for allergies, Tagamet for indigestion, for example — the list is long — have all experienced the importance of G protein signaling in cell processing.

"If we know how G protein signaling works in cells, it gives you all that many more options to address these diseases," Willardson said.

The team's discovery answers a major biomedical question: How did the beta and gamma subunits fold together from their separate components?

The key is the role the protein called phosducin-like protein (PhLP, pronounced "flip") plays to help body cells regulate themselves when they are externally stimulated, Willardson said. For 12 years, researchers have known that PhLP is involved in G proteins signaling, but not how. Until now.

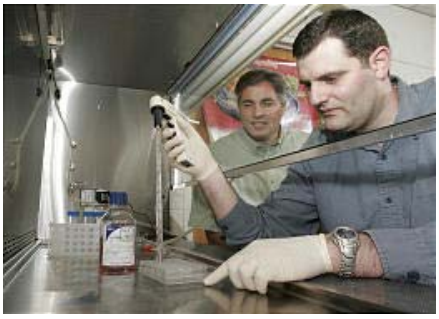
There were not many hints, so this made a splash," said Willardson. "Eventually, this kind of research leads to treatments."

For a decade, scientists have tried to figure out what PhLP did. They knew it bound to the gamma and beta subunits but first thought it inhibited signaling, Willardson said. Groups working with single-cell organisms found that, when they knocked out the gene for PhLP, the opposite of what was expected happened.

Willardson's team used a method called RNA interference to remove PhLP in mammalian cells. The result was no signaling, and no subunits of the G proteins being produced in the cell.

"We determined they were not coming together as a complex," he said.

They believe now that the PhLP stabilizes the beta in its fold (the subunits fold into complex shapes; beta, for instance, looks like "a propeller with seven blades," Willardson said) and that allows it to mesh in with gamma.



Researchers Georgi Lukov, left, and Barry Willardson

"This is an incredibly nice study," said researcher Patrick J. Casey of Duke University Medical Center, quoted in a release about the research.

"The question of just how the G protein beta-gamma dimer is formed in cells has been studied by many, including ourselves, but despite all these efforts the molecular basis for the process has remained elusive until now. This demonstration that PhLP is the critical element in the process not only opens a new avenue of investigation in the field of G protein signaling but also adds a new element to our understanding of how protein complexes form in cells."

Funding for the research was provided by the National Institutes of Health and the National Science Foundation. Besides Willardson, the researchers included BYU graduate students Georgi L. Lukov and Ting Hu, as well as Joseph N. McLaughlin and Heidi E. Hamm of the Department of Pharmacology at the Vanderbilt University Medical Center.

College Publications

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D. Boda, M. Valisko, B. Eisenberg, D. Henderson, W. Nonner, and D. Gillepsie, "Monte Carlo Simulation of Ionic Systems in the Presence of Dielectric Boundaries: Application to the Selectivity of Calcium Channels," *Presented at the 6th Liblice Conference on the Statistical Mechanics of Liquids*, (June 2006).

D.J. Russell and L.D. Hansen, "Calorimeters for Biotechnology,"*Thermochimica Acta*, **445**, 151-159 (2006).

J. Boerio-Goates, G. Li, L. Li, T.F. Walker, T. Parry, and B.F. Woodfield, "Surface Water and the Origin of the Positive Excess Specific Heat for 7nm Rutile and Anatase Nanoparticles," *Nano Letters*, **6**, 750-754 (2006).

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S.P. Ziemer, T.L. Niederhauser, E.D. Merkley, J.L. Price, E.C. Sorenson, B.R. McRae, B.A. Patterson, and E.M. Woolley, "Thermodynamics of proton dissociations from aqueous serine at temperatures from (278.15 to 393.15) K, molalities from (0.01 up to 1.0) mol * kg^{-1}, and at the pressure 0.35 Mpa: Apparent molar heat capacities and apparent molar volumes of serine, serinium, chloride, and sodium serinate," *Journal of Chemical Thermodynamics,* **38**, 634-648 (2006).

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D.W. Lonsdale, C. Tustison, C.G. Parker, and D.W. Embley, Formulating queries for assessing clinical trial eligibility, Proceedings of the 11th International Conference on Applications of Natural Languages to Information Systems (NLDB 2006), Klagenfurt, Austria, 31 May - 2 June 2006, 82-93.

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J. K. Rigby, "Memorial to Norman Dennis Newell (1909-2005)," *Memorials, Geological Society of America*, **35,** 13-16 (2006).

J. K. Rigby, "Opinion 2134 (Case 3316) Hindia Duncan, 1879 (Porifera): Conserved, *Bulletin of Zoological Nomenclature*, **31:1**, 54-55 (2006).

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T, Jarvis, T, Kimura, A. Vaintrob, "Gromov-Witten Theory of Spin Curves and Orbifolds," *Contemporary Mathematics,* **403** (2006).

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