OREGON ACADEMY OF SCIENCE
Newsletter

Volume 68, Number 2 July 2010

PORTLAND COMMUNITY COLLEGE
to Host the 70th Annual OAS Meeting February 26, 2011

Preparations are already underway for next year's OAS meeting! Dr. Dieterich Steinmetz, interim division dean of PCC Sylvania Science and Engineering, is at the helm of the Oregon Academy of Science during 2010-11. In addition to his administrative duties, he teaches human anatomy and physiology. Dr. Steinmetz joined Portland Community College in 1997 as a part-time instructor, leading laboratories in anatomy and physiology, before becoming full-time in 2002. Following his undergraduate studies in biology at Yale, and graduate studies in public policy and biochemistry at the University of Oregon, Dr. Steinmetz earned his medical degree from Oregon Health & Science University in 2001. Stay tuned for further announcements about the meeting and registration this fall. We hope to see you there, either as a presenter or attendee!

2010 Meeting Highlights

What makes a durable heart in the womb?
By Krista Reichard

Dr. Kent Thornburg, Professor of Cardiovascular Medicine and Director of the Heart Research Center at Oregon Health & Science University, shared thought-provoking highlights of his research which addresses the broad question: What factors in the womb contribute to the creation of a durable heart?

In spite of improvements in clinical care over the last thirty years, cardiovascular disease is still the number one cause of death in the U.S. and other western countries (Thornburg et al, 2010). Evidence from clinical and experimental studies shows that fetal growth plays a significant role in an adult's development of cardiac disease. The maternal environment, which modulates gene expression in offspring, may be more influential than risks conveyed by an individual's genetics (Gluckman et al., 2008).

Maternal obesity is a significant factor which contributes to this problem. Even though a pregnant woman may be overweight, her overall nutrition might be poor, and this low nutritional status is conferred to the fetus. Often the result is a slow fetal growth rate and low birth weight. Dr. Thornburg postulated babies with a low birth weight are at higher risk of developing cardiovascular disease as adults; studies show a correlation between lower birth weight and increased rates of coronary heart disease, stroke, and type 2 diabetes.

One hypothesis explaining this phenomenon is that adaptive responses the fetus makes *in utero* (changes in metabolism, hormone production, and tissue sensitivity to hormones) affect the long-term risk of disease development. "Maternal diet and body composition strongly influence placental growth, levels of inflammation, nutrient transport capacity and oxidative stress, with subsequent effects on offspring health" (Thornburg et al., 2010, p. S54). There may even be an intergenerational effect—environmental and nutritional factors which affected the growth and development of our grandmothers are passed to our mothers which are then passed on to us. Epidemiological studies have linked the development of diabetes in grandchildren with the nutritional status of grandparents. "These considerations raise the possibility that familial clusters of metabolic disease may have an environmental and epigenetic basis, rather than purely a multigenic basis" (Gluckman, et al. 2008, p. 69).

Dr. Thornburg's presentation also focused on how mechanical forces alter gene expression in prenatal heart development. Specifically, he described studies

related to cardiomyocyte (cardiac muscle cell) growth and maturation. His research models are designed to study the role of shear and wall stresses as signals to developing cardiac structures. In related studies, rat pups which experienced low blood oxygen levels during gestation developed fewer but larger cardiomyocytes and were more susceptible to infarction as adults, compared with pups exposed to normal *in utero* oxygen levels.

When discussing the results of a study Dr. Thornburg conducted with Dr. David Barker on preeclampsia, high blood pressure and the incidence of stroke, Thornburg said, "The most important message from these studies is that adversities in pregnancy, like high blood pressure in the mother, can lead to compromises in the fetus whereby vascular structures are inadequately formed in the womb. In addition, the expression of genes that regulate the integrity of vascular structure and function in the brain may be permanently altered by epigenetic mechanisms" (Oregon Health and Science University, 2009).

What are the repercussions of Dr. Thornburg's work? Prenatal nutrition and overall maternal health are crucial to nurturing healthy babies, not merely for short-term benefits but to improve health throughout adult's lives. To reduce the incidence of chronic disease in adults, our health information systems in the U.S. need to change. Doctors and others involved in health education need to place a stronger emphasis on teaching young people about maternal health and nutrition issues before they become pregnant.

Interested in learning more about Dr. Thornburg's research? Recent publications include the following:

Barker, D. J., Thornburg, K. L., Osmond, C., Kajantie, E. & Eriksson, J. G. (2010). The surface area of the placenta and hypertension in the offspring later in life. *International Journal of Developmental Biology, 54* (2-3), 525-530.

Gluckman, P. D., Hanson, M. A., Cooper, C. & Thornburg, K. L. (2008, July 3). Effect of *in utero* and early-life conditions on adult health and disease. *New England Journal of Medicine, 359* (1), 61-73.

Thornburg, K. L., O'Tierney, P. F., & Louey, S. (2010, March). Review: The placenta is a programming agent for cardiovascular disease. *Placenta, 31*, Suppl A: S54-59.

Oregon Health and Science University. (2009, April 11). Discovery spotlight: Kent Thornburg and David Barker. Retrieved from http://www.ohsu.edu/ohsuedu/academic/som/dean/somnews.cfm?newsID=477

Congratulations, Kip Ault and Jean Eames!

Dr. Charles (Kip) Ault, Professor of Education at Lewis and Clark College was the recipient of the Outstanding Educator Award (Higher Education) in 2010. Dr. Ault was commended for his understanding of practical and theoretical aspects of successful teaching and his mentorship of students in education programs at Lewis and Clark. Dr. Ault obtained a Ph.D. in science and environmental education at Cornell University and demonstrates an ongoing passion for his subject—in addition to publishing several articles in the field he has been actively promoting science education in Oregon through organizations such as OAS, OMSI, OHSU, and PRISM.

Ms. Jean Eames, teacher at Benson Polytechnic High School in Portland, was the recipient of the Outstanding Teacher Award (K-12). Ms. Eames has been at BPHS since 1985 and teaches biology and chemistry courses in which she encourages her students to participate in research and extracurricular science activities. Jean is known for challenging her students and shows a deep commitment to their growth as self-reliant learners. She has provided a myriad of opportunities for students outside the classroom and has been involved with the Mathematics, Engineering, Science Achievement (MESA) program, Science Bowl, Ocean Bowl, and ISEF Science Fairs. Former students have noted that Ms. Eames significantly affected their future careers in a positive way.

This is no ivory tower: Summer research at the University of Portland

By Lindsay Lermo

Undergraduate researchers from the University of Portland are friendly and delighted to share their progress in their research. Over pizza and ice cream each Thursday night this brilliant group of minds comes together to report on the recent developments in their research, brainstorm solutions to problems, and encourage each other in their work.

Two projects were the focus of the evening: one in physics, the other in biochemistry.

Students studying under Dr. Barbara Breen of University of Portland, and Dr. John Lindner of College of Wooster, Ohio, presented their current standing in their physics project. The students are studying one-way coupling, building both a mechanical and an electronic system to demonstrate the unique points of this phenomenon. A system of levers forces waves to transmit only in one direction. A stream of water hits a lever, forcing it to one side. The movement of the lever

causes the stream to be shifted, setting off a chain reaction that forms a unidirectional wave. If the system has an odd number of components, the wave will never reach quiescence. If an even number is set up, two waves will form that will eventually annihilate each other, no matter the original position of the lever. In the electronic version, the position of the levers is shown using LEDs. Different colors of LED lights indicate individual waves forming by this process.


Aaron Doud and a two-dimensional electronic array

The four students working on this project are Aaron Doud, Stuart Tanasse, Andrew Tanasse and Jamie Grimm. This year, they are building a new mechanical model. The framework of their model was built entirely using 3-D printing, eliminating the need for screws and springs, and making the overall mechanism much more elegant. The design is also smaller – approximately half the size of the original model, and uses much less water. Meanwhile the students are improving the electronic version, and are in the process of developing a two dimensional one-way coupling system. When the LEDs are linked in a 13x13 grid, waves traverse the board diagonally. Although I was unable to see a demonstration, the students have put together a working prototype.


Andrew Tanasse, Stuart Tanasse, Dr. Barbara Breen, Dr. John Lindner, Jamie Grimm, and Aaron Doud

In the biological sciences, students Brie Brown and Nate Bell are studying Wnt proteins under Dr. Jeff Brown. Wnt proteins are signaling proteins that interact with “Frizzleds” proteins. Not much is known about the specific mechanism of this reaction, but it is known the signaling sequence functions in cell-to-cell communication and differentiation. The Wnt signaling pathway functions as a mitogen, which causes cells to begin mitosis. A biological miscue in this sequence, causing cells to split uncontrollably, has been implicated in some cancers.

Brown and Bell are specifically interested in how glycosaminoglycans (GAGs), a type of unbranched polysaccharide that is found on the cell membrane or in the extracellular matrix, interact with Wnt and Frizzleds. They are performing different assays to analyze how the Wnt signaling pathway is activated, at what point the GAGs and Wnt proteins are associated with each other, and how the pathway is affected by their presence or absence.

Research under Dr. Breen and Dr. Lindner is funded by the Clare Boothe Luce Program of the Henry Luce Foundation. Research under Dr. Brown is funded by a Murdock Life Science Grant and funds from University of Portland.

Solving biochemical mysteries: Summer research at Concordia University

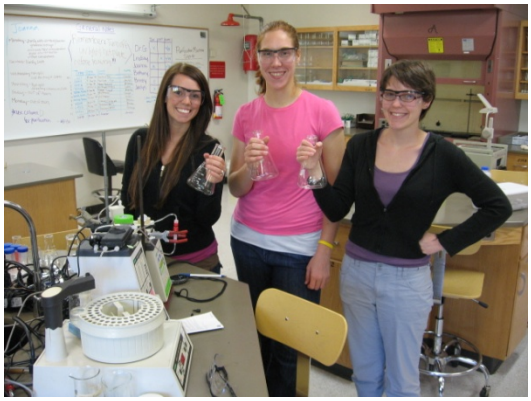
By Krista Reichard

This summer science labs at Concordia University are abuzz with five undergraduate researchers conducting novel investigations in biochemistry. Students are working with Dr. Michael Godsey, associate professor of chemistry and biochemistry, on two projects. The first is a study of kinetics of deoxycytidine kinase (dCK) mutants. What are those, you ask? Deoxycytidine kinase is an enzyme in the group of phosphorylating enzymes; it recycles purine bases so they may be reused in DNA synthesis. Dr. Godsey began investigating dCK while a post doctoral researcher at the University of Illinois at Chicago. At UIC Dr. Godsey examined the UTP and ATP preference of the enzyme; students’ research this summer will extend this work.

Why is research on this enzyme important? Current anticancer therapies generally broadcast drugs to all body tissues, harming healthy cells and causing deleterious side effects. Creating chemotherapy drugs that are cell specific would alleviate these problems. Many drugs used in cancer treatment (called nucleoside analogue prodrugs) are not activated until they cross the cell membrane. One of the enzymes that activates prodrugs is dCK. If the activity of the enzyme could be sped up, nucleoside analog prodrugs

could be delivered more quickly to cancerous cells, and the drugs could be targeted at affected tissues more effectively. The mutant forms of dCK being investigated by the students were designed in hopes of not only increasing the rate of the enzyme, but also altering its substrate choice.

The second project may present more challenges. Students are studying a protein of unknown function from the soil bacterium, *Bacillus cereus*. Dr. Godsey became familiar with this protein while working for a structural genomics laboratory at Northwestern University. The protein has a structural motif with limited similarity to active sites on bacterial toxin proteins, such as those from diphtheria and cholera. One question students will address is: Does this protein have the same enzymatic activity as toxin proteins with a similar structure? Students will develop a bacterial-putative toxin expression system and then purify it. The difficult next step is measuring its activity, which has not yet been done, according to Dr. Godsey. Some students hired for the summer already have experience growing and purifying proteins, skills they acquired in biochemistry courses. Now they will develop a protocol to measure the protein's activity. Outcomes from this research could inform the development of a treatment for poisoning from a *B. cereus* infection.



Joanna Fridlund, Breanna Wentz, and Lindsay Lermo

These projects are ideal for classroom use because they are novel, and students will learn about bacterial growth and protein expression, enzyme purification, and kinetics in a system which has not yet been investigated. Students will also need to hone their use of various techniques and equipment such as cell incubators, gel boxes, and spectrophotometers. This is the first summer CU students will conduct original scientific research in an on-campus laboratory with the leadership of a principal investigator and receive financial compensation. This represents a significant step for the university and considerable intellectual growth for the students involved. In the fall researchers will share their findings with other Concordia students and faculty. Then Dr. Godsey anticipates students will also present any significant results at a regional meeting such as the annual Oregon Academy of Science symposium or the Murdock Undergraduate Research Conference. The ultimate goal is to publish research results in a peer-reviewed journal.

Bethany Taylor, Dr. Michael Godsey, and Jaclyn Einspahr

Research this extensive could not have been initiated without institutional support. The Concordia Math/Science department was fortunate to receive a grant from an anonymous donor, and the administration donated housing for two student researchers. Additional funds were obtained from the department and a faculty research grant awarded to Dr. Godsey this spring. Dr. Godsey is donating his time this summer to support these research endeavors.

UPCOMING PROFESSIONAL CONFERENCES

Association of Pacific Coast Geographers
Coeur d'Alene Resort in Coeur d'Alene, Idaho
September 15-18, 2010
Conference Information:
http://www.uidaho.edu/sci/geography/apcg2010

Oregon Science Teachers Association
Colton High School in Colton, Oregon
October 8, 2010
Conference Information:
http://www.oregonscience.org/conference.php

OPPORTUNITY

The OAS is seeking energetic individuals to lead the organization in 2011-2012! Please consider running for President and hosting the annual conference at your institution in 2012. Take this opportunity to showcase your organization and facilities to fellow members and conference attendees. Please contact current OAS President, Dieterich Steinmetz, at dsteinme@pcc.edu or 503-977-4226, if you are interested or would like more information.

OREGON ACADEMY OF SCIENCE OFFICERS AND SECTION CHAIRS

President: Dieterich Steinmetz, dsteinme@pcc.edu
Portland Community College, Sylvania

Past-President: Rici Hallstrand, rhallstrand@cu-portland.edu
Concordia University

President Elect: TBD

Secretary: position open

Treasurer: Elizabeth Atkinson, eatkins@linfield.edu
Linfield College

Archivist: Frederick Hirsch

Proceedings Editor: Heide Deditius-Island
island@pacificu.edu Pacific University

Newsletter Editor: Krista Reichard, kreichard@cu-portland.edu Concordia University

Webmaster: Rici Hallstrand

OAS SECTION CHAIRS 2010 - 2011

BIOLOGY:
Dwight Kimberly, dkimberly@georgefox.edu
George Fox University

Jeff Duerr, jduerr@georgefox.edu
George Fox University

CHEMISTRY:
Angela Hoffman, hoffman@up.edu
University of Portland

Tom Munson, tmunson@cu-portland.edu
Concordia University

ECONOMICS:
Hamid Bahari-Kashani, baharih@wou.edu
Western Oregon University

GEOGRAPHY:
Joe Poracsky, poracskj@pdx.edu
Portland State University

Hunter Shobe, hshobe@pdx.edu
Portland State University

GEOLOGY:
Scott Burns, burnsS@pdx.edu
Portland State University

Jeff Myers, myersj@wou.edu
Western Oregon University

HEALTH SCIENCE:
Satin Salehi, salehis@onid.orst.edu
Oregon State University

HIST./PHIL./SOC. STUDY OF SCIENCE:
Dave Boersema, boersema@pacificu.edu
Pacific University

MATHEMATICS/COMPUTER SCIENCE:
Tim Thompson, timothy.thompson@oit.edu
Oregon Institute of Technology

PHYSICS:
Scott Prahl, prahl@bme.ogi.edu
St. Vincent Medical Center

POLITICAL SCIENCE:
Adele Kubein, kubeina@onid.orst.edu
Oregon State University

PSYCHOLOGY:
David Foster, fosterd@wou.edu
Western Oregon University

Heide Deditius-Island, island@pacificu.edu
Pacific University

SCIENCE EDUCATION:
Karen Bledsoe, bledsoek@wou.edu
Western Oregon University

SOCIOLOGY/ANTHROPOLOGY:
TBD

Richard Mitchell, mitchelr@onid.orst.edu
Oregon State University