The PR-LSAMP Annual Best Practices Conference on Teaching and Learning

ABSTRACTS OF PRESENTATIONS AND POSTERS

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Dorado Embassy Suites Hotel

ABSTRACTS OF PRESENTATIONS

"How Our Inquiry and Designed-based Programs are Impacting STEM Education"

Dr. Robert Chang, Director, Materials Research Institute
Northwestern University; Evanston, IL.

Abstract

The Materials World Modules (MWM) program develops materials topic-based supplementary content for use in secondary science classrooms. It uses inquiry and design as the basis to stimulate discovery and creativity in students who use the modules. The program also offers teacher training, evaluation and assessment of its activities. Materials topics include: polymer, sports materials, biotechnology, nanotechnology, composites, and others. MWM provides teachers and students with printed booklets, web based concepts, and related kits for the classrooms. In this talk I will discuss how MWM are being used, and results from nation-wide field tests will be presented. In addition to the MWM program, I will briefly introduce activities at the National Center for Learning and Teaching in Nanoscale Science and Engineering. I will discuss how new approaches to teaching nanoscience are being developed

Dr. Robert H. Chang

Dr. Chang earned his BS and PhD in Physics at MIT and Princeton respectively. He spent 15 years performing basic research at Bell Labs (Murray Hill). During the past 20 years he has been studying nanostructured materials and also served as director of the Materials Research Institute at Northwestern University. Chang was the founding president of the International Union of Materials Research Societies (IUMRS) with adhering bodies on all continents, and he has played a significant role working with NSF in establishing the Materials World Network. His passion in science education has led him to develop the Materials World Modules (MWM) program for pre-college students nationwide and more recently he became the director of the NSF-National Center for Learning and Teaching in Nanoscale Science and Engineering (NCLT). Chang is a recipient of the NSF Director's Distinguish Teaching Scholar Award in 2005.

‘‘Using “Ten Equations that Changed Biology” in Implementing NRC Bio 2010’s Recommendations for More Mathematics in Undergraduate Biology Education”

Dr. John R. Jungck, Co-Founder of Bio-QUEST

Mathematics has played exceptionally important roles throughout the history of biology. In the 20th century, at least five Nobel Prizes in Physiology and Medicine involved direct contributions from mathematics. These mathematical contributions included: (1) reworking complete trees of life with sequence alignment and phylogenetic tree algorithms as well as the assembly of huge genomes such as we saw in the release of the human genome, (2) three dimensional imaging that has transformed medical diagnosis through computer assisted tomography and magnetic resonance imaging, (3) epidemiological modeling of the spread of bacterial and viral infections, etc. In 2003, the NRC made eight major recommendations for the improvement of undergraduate biology education in its publication: BIO2010: Transforming Undergraduate Education for Future Research Biologists <http://www.nap.edu/books/0309085357/html/>. The first two of these recommendations both emphasized the need for more attention to the inclusion of more mathematics:

> “it is important that all students understand the growing relevance of quantitative science in addressing life-science questions. Thus, a better integration of quantitative applications in biology would not only enhance life science education for all students, but also decrease the chances that mathematically talented students would reject life sciences as too soft.” … “Most biology majors take no more than one year of calculus, although some also take an additional semester of statistics. Very few are exposed to discrete mathematics, linear algebra, probability, and modeling topics, which could greatly enhance their future research careers. These are often considered advanced courses; however, many aspects of discrete math or linear algebra that would be relevant to biology students do not require calculus as a prerequisite. While calculus remains an important topic for future biologists, the committee does not believe biology students should study calculus to the exclusion of other types of mathematics.”

Explicit strategies for implementing these recommendations were the subject of a follow-up conference entitled “Meeting the Challenges: Education Across the Biological,

Mathematical and Computer Sciences" < http://www.maa.org/mtc/ > and a book published by the Mathematics Association of America entitled: Math & Bio 2010: Linking Undergraduate Disciplines (ISBN 0-88385-818-5). We, members of the BioQUEST Curriculum Consortium, were funded to develop modules to address these challenges through a new initiative: The Biological ESTEEM Project (Excel Simulations and Tools for Exploratory, Experiential Mathematics) <http://www.bioquest.org/esteem/>. ESTEEM is an open source, creative commons (copy left) project so all materials are freely downloadable and modifiable. More biology students take Calculus than any other single constituency. Too frequently, textbook authors have unappreciated mathematics in biology curricula because they assume that biology students have an inadequate mathematical preparation. This practice: (1) deskills many biology students, (2) is inconsistent with our requirements, (3) misrepresents contemporary biological research, and, (4) under prepares students to read many articles or to contribute to many areas of biology. However, the recent calculus and biology reform movements have empowered students to actively investigate the behavior of many famous mathematical models in biology. While numerous recent publications are replete with numerous models, there is a need to identify a succinct list of achievements that represent the power of mathematics in biology. Hence, "ten equations that changed biology" and a brief description of their historical importance are presented here with BioQUEST software instantiations in order to: first, draw attention to a variety of mathematical models that have been intrinsic to significant discoveries in biology and, second, to illustrate that the computational tools are currently available for engaging students in active investigation of biological phenomena and the development of systematic strategies for biological problem solving. Also, this talk will be the initial representation of a four-year collaborative project: NUMBERS COUNT!: "Numerical Undergraduate Mathematical Biology Education: exploring with Statistics, Computation, modeling, and quantitative daTa;" an HHMI Project, Claudia Neuhauser, University of Minnesota, PI. These offerings will be discussed in terms of their relevance for curricular initiatives in response to the NRC Bio 2010 report and the NIH/NSF/MAA "Meeting the Challenges" conference, that responded to the NRC's recommendations.

Dr. John R. Jungck

John R. Jungck is the Mead Chair of the Sciences and Professor of Biology at Beloit College. He specializes in mathematical molecular evolution, history and philosophy of biology, and science education reform. In 1986, he co-founded the BioQUEST Curriculum Consortium, a national consortium of college and university biology educators devoted to curricular reform across the nation. It promotes quantitative, open-ended problem solving, collaborative learning, peer review, research, and civic engagement/social responsibility. He has held many editorial positions: Editor, The BioQUEST Library; Editor, Bioscene: Journal of College Biology Teaching; Editor, American Biology Teacher; Associate Editor, Bulletin of Mathematical Biology; Book and Software Editor, BioScience; Associate Editor, Journal of Computers in Mathematics and College Science Teaching; and, Editorial Boards of several journals: Evolutionary Bioinformatics Online, BioSystems: Journal of Molecular, Cellular and Behavioral Origins and Evolution, American Journal of Undergraduate Research, and Cell Biology Education. He is the Chair of the National Academies of Science's US National Committee of the International Union of Biological Sciences, Chair of the Education Committee of the Society for Mathematical Biology, Vice President of the Commission on Biological Education of the International Union of Biological Sciences, on the Governing Board of the National Numeracy Network, and Chair of the Awards Committee of the American Institute for Biological Sciences. He served on two National Research Council committees: the Board on Science Education and the Information Technology committee. His awards include the 2004 AIBS Education Award and an honorary doctorate from the University of Minnesota. He is a Fulbright Scholar (Thailand), a Mina Shaughnessy Scholar, a Fellow of the National Institute of Science Education, and a Fellow of the American Association for the Advancement of Science.

"Computational Methods Applied to Biological Systems"

Dr. Denny S. Fernandez and Dr. Elio Ramos, UPR-Humacao

Abstract

A modern tendency in sciences and applied mathematics move toward interdisciplinary research and education. In order to engage with this trend the undergraduate student in Natural Sciences needs mathematical and computational tools to study complex models and the undergraduate student in Mathematics and Computation needs the conceptual tools to recognize the complexity of the natural world. We have developed an undergraduate course that integrates ecological concepts with computational and mathematical modeling techniques. This includes the enhancement of an experimental course that has been taught twice by us since 2002 at the University of Puerto Rico at Humacao. Our approach is based in a co-teaching strategy combining our teaching experiences in ecology (D.F.) and in computational sciences (E.R.). The intended audience of the course is undergraduate STEM students.

Dr. Denny S. Fernandez

Born in Baracoa, Cuba, grew up in Ecuador and Venezuela, obtaining a BS degree in Biology in Caracas (Simón Bolívar University) and a MSc in Agronomy at Central University of Venezuela. During those years his research interest was plant ecophysiology, specifically crop plants and pastures. In Puerto Rico he obtained his PhD in 1997, from the Intercampus Doctoral Program (University of Puerto Rico, Rio Piedras and Medical Sciences campuses). His doctoral dissertation and other parallel projects were in the field of ecophysiology of tropical trees, working in El Yunque (Luquillo Forest) and Costa Rica (La Selva). In his research projects and publications is common the use of mathematical tools for the analysis of physiological and ecological processes (functional analysis of plant growth, photosynthetic response, water use, patterns of light distribution). During three years he served as Project Coordinator of the Puerto Rico Louis Stokes Alliance for Minority Participation, letting him to know about the experiences and needs of math and science undergraduate education, and the importance of undergraduate research and an interdisciplinary curriculum. Currently

he is an Associate Professor in the Department of Biology, University of Puerto Rico at Humacao, where he teaches courses in the areas of Botany and Ecology. He has mentored about 20 students in the last five years, mostly through the PR-LSAMP program and CREST-CATEC projects. His main teaching interest is the incorporation in Biology courses of activities to promote interdisciplinary teaching and undergraduate research as learning strategies.

Dr. Elio Ramos

Elio Ramos was bon in Aibonito Puerto Rico, on 1966. He obtained a B.S. degree in Applied Physics from the University of Puerto Rico at Humacao (UPRH) in 1989. As an undergraduate student he worked in the Astronomical Observatory at the UPRH. In 1996 he obtained a M.S.Degree in Applied Physics from George Mason University (VA) and in

1997 a PhD in Computational Sciences and Informatics from the same university. In his PhD thesis, under the supervision of Professor Menas Kafatos, he applied computational and statistical modeling to astrophysical data. As a doctoral student he was a visiting researcher at the Center for Extreme Ultraviolet Astrophysics (CEA) at the University of California at Berkeley and the Goddard Space Flight Center (GSFC) in Maryland. During the summer of 1998 he was a visiting researcher in the Physics Department at the University of Crete and the Foundation for Research and Technology Hellas (FORTH) . He has published several scientific articles in profesional magazines and the results of his research has been presented in many scientific conferences. Currently he is a full professor at the Department of Mathematics at the UPRH and since 2003 he has been the Academic Coordinator of the B.S. Program in Computational Mathematics. He has supervised more than 20 undergraduate students in research projects ranging from computational modeling to data analysis. The results of this projects have been presented in several scientific congresses such as SACNAS and NCUR.

"Mentoring STEM Students: Myths, Modes, and Models"

Dr. Howard Adams, President
H.G. Adams and Associates

Abstract

It is generally agreed that STEM (science, technology, engineering and mathematics) students thrive and excel best in a learning environment where they are accepted, nurtured and mentored by supportive faculty, administrators, staff and other student peers. The reoccurring theme often heard among STEM educators is "How?"

This seminar examines the question of "How?" by exploring mentoring as a proven strategy for developing and retaining STEM students. The session is designed to present "best practice" strategies for forming and maintaining effective mentorship alliances in the context of the developing and nurturing academic/career/personal/professional development of STEM students.

Key topics:

- The Language and Philosophy of Mentoring
- Meeting the Informational Needs of STEM Students
- The 3Ps of Effective Mentoring Practices
- Applying Principles of Mentoring, Coaching and Enabling Support to Foster the Development and Retention of STEM Students

Dr. Howard Adams

HOWARD G. ADAMS, Ph.D. is Founder and President of H.G. Adams & Associates, Inc., a Norfolk, VA based consulting company that provides human resources services and product to educational, governmental and industrial organizations. From 1978 to 1994 Adams served as Executive Director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. (GEM). Prior to joining GEM, Adams served as Vice President for Student Affairs at Norfolk State University.

Adams is a leading expert on mentorship and internship programs and has written, lectured and consulted extensively on developing people in both academic and workplace settings. He is a sought after keynote speaker and seminar presenter, having spoken at over 500 colleges and universities and numerous national conferences and conducted training for a number of fortune 500 companies. He is the author or coauthored of fifteen self help guides and handbooks and has also authored two books.

In 1989 President Ronald Reagan named Adams to the US Congressional Task Force on Women, Minorities and the Handicapped in Science & Technology. In 1996, Adams was named by President Clinton as one of the first recipients of the Presidential Awards for Excellence in Science, Mathematics, Engineering and Mentoring. He was named a “20th Century Outstanding Educator” by Black Issues in Higher Education in 1999; in 2002 the National Society of Black Engineers awarded Adams its Golden Torch Award “Lifetime Achievement in Academia”; and the Norfolk State University School of Science and Technology’s, recognized him with its “2004 Alumni Star”. Adams holds a B.S. from Norfolk State University, M.S. from Virginia State University Ph.D. from Syracuse University.