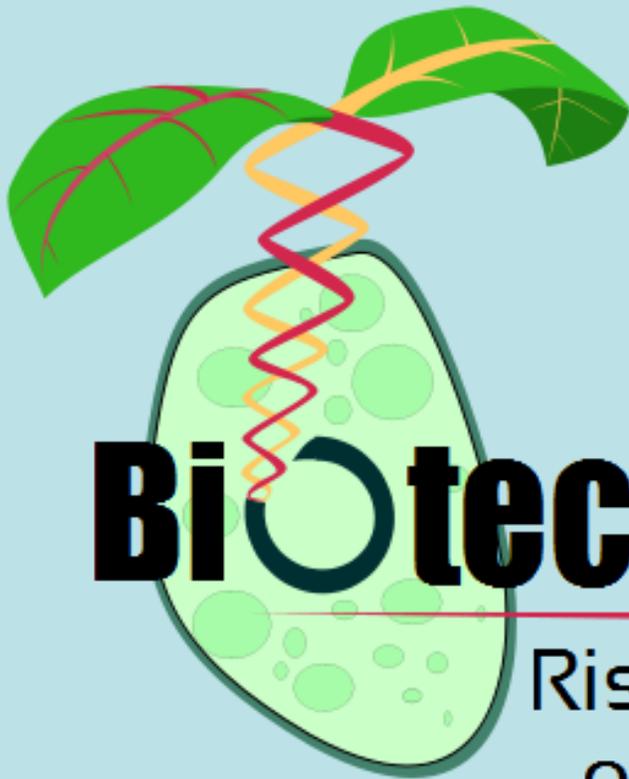


Purdue Student Pugwash

Midwest Regional Conference



Biotechnology

Risks and Rewards
of Rewriting Life

March 30-31, 2012

Purdue University

Dear Conference Attendee,

On behalf of Purdue Pugwash, I would like to welcome you to the seventh annual Purdue Student Pugwash Midwest Regional Conference, *Biotechnology: Risks and Rewards of Rewriting Life*. This conference is our signature event of the year and embodies our mission of educating the public and promoting discussion and critical examination of socially important issues in science and technology. Each year, we choose a topic we feel is both timely and especially relevant to both science and society and host the conference to explore that topic in detail.

Ever since I joined Purdue Student Pugwash, we have discussed the idea of a conference focusing on biotechnology. Previous conferences have explored the integrity of science, space exploration, energy and the environment, healthcare, emerging technologies, and global access to resources and information, yet none have tackled this revolutionary technology that gives rise to so many urgent social and ethical issues. With many of our longtime members graduating this year, we decided it was finally time to examine this important topic

Within this booklet you will find a conference itinerary, information on each session, a map of the locations of each talk, information about our organization, and biographies of each of the speakers and executive board members of Purdue Student Pugwash. Pugwash is all about critical thinking, curiosity, and discussion, and we strongly encourage you to ask questions and engage in dialogue with both speakers and fellow conference attendees.

We thank you for supporting this event and Purdue Student Pugwash in general and hope that you will find this conference to be a rewarding experience!

Sincerely,

Dane Sauffer
President
Purdue Student Pugwash

We would like to thank the following sponsors for their support:

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Conference Information

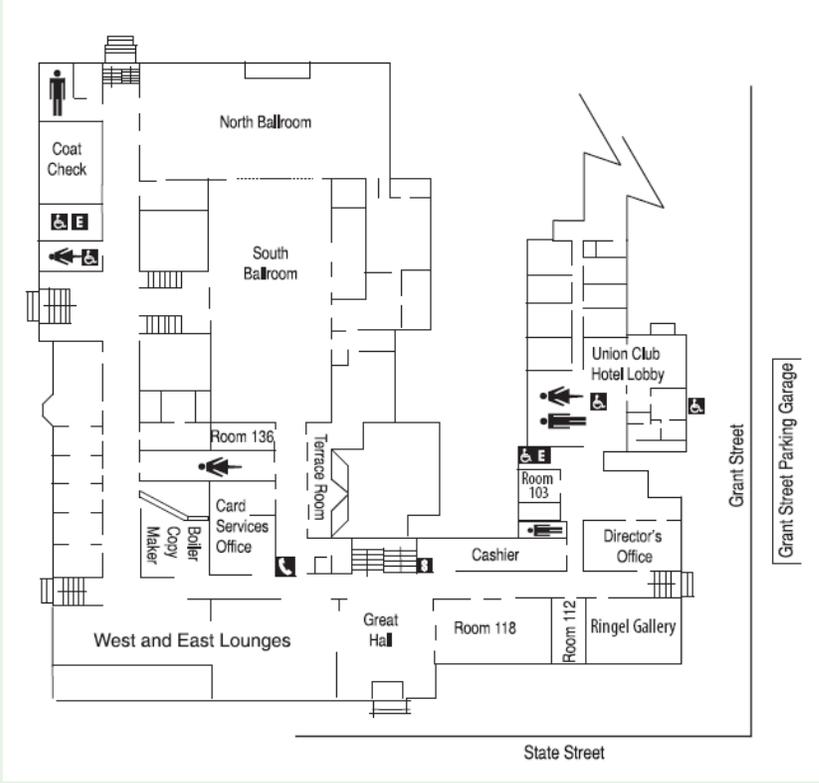
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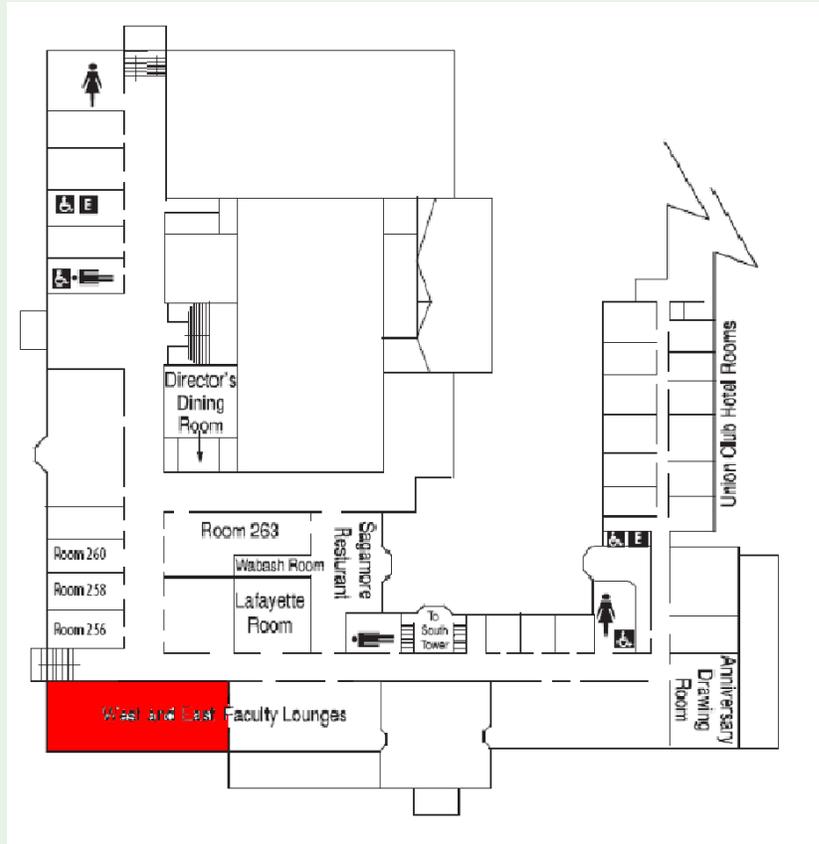
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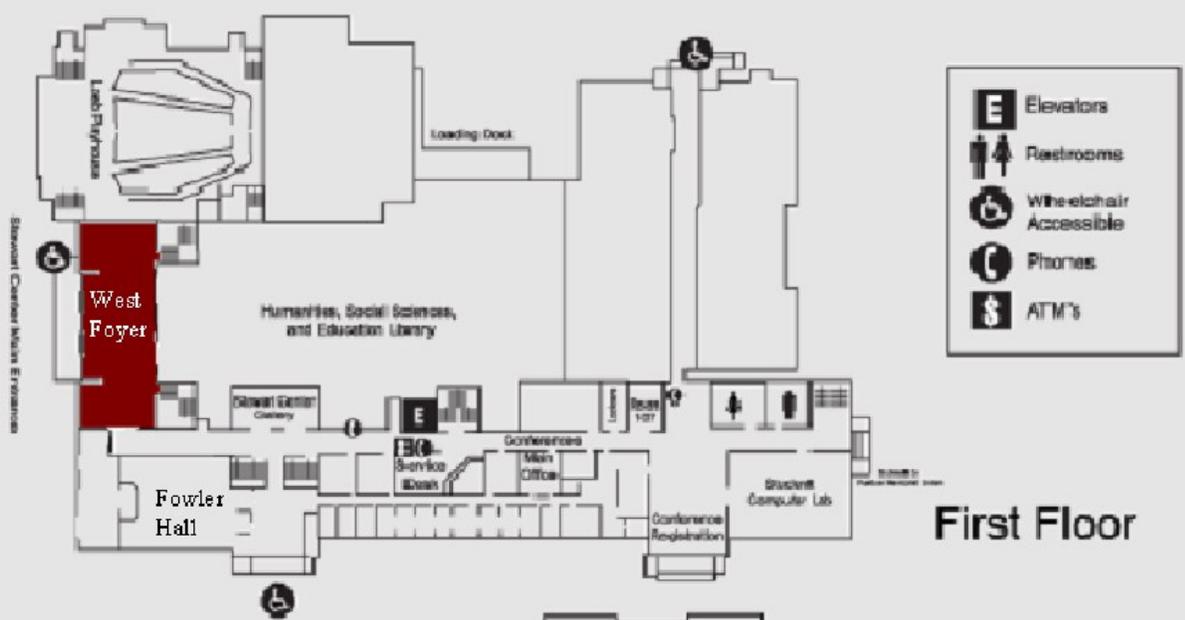


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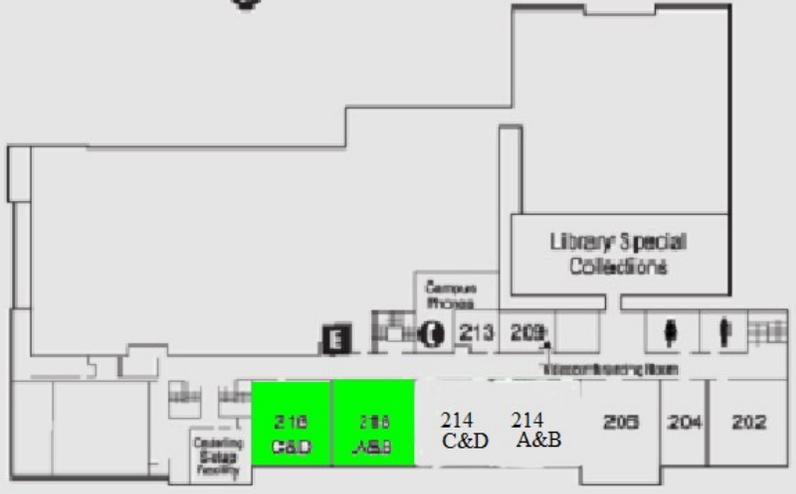
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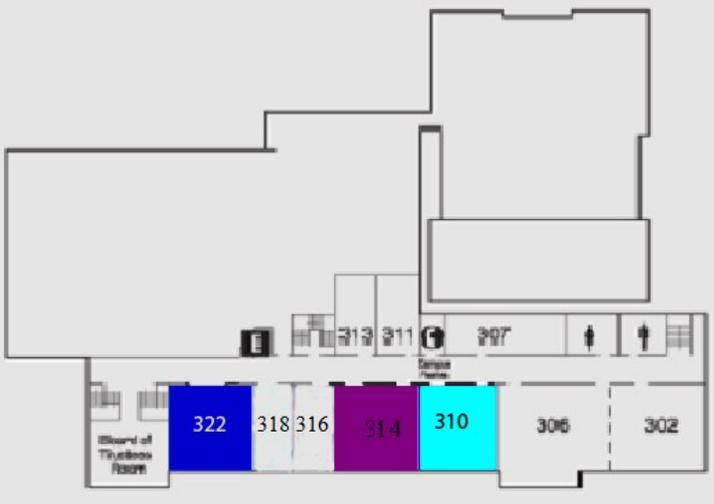
SECOND FLOOR



First Floor



Second Floor



Third Floor

- West Foyer
- Room 218 ABCD
- Room 310
- Room 314
- Room 322

FRIDAY, March 30, 2012

- 5:30—6:00 pm** **Reception & Check-in**
 Purdue Memorial Union: West Faculty Lounge
- 6:00—6:10 pm** **Opening Remarks**
 Peter Meckl, Ph.D.
 Dane Sauffer, Purdue Student Pugwash President
 Purdue Memorial Union: West Faculty Lounge
- 6:10—7:10 pm** **Synthetic Life and Society**
 Jenna Rickus, Ph.D.
 Purdue Memorial Union: West Faculty Lounge
- 7:15—8:15 pm** **Linking Neurons to Electronics:
 Implants, Prosthetics, and Beyond**
 Pedro Irazoqui, Ph.D.
 Purdue Memorial Union: West Faculty Lounge
- 8:20—10:30 pm** **Conference Social**
 Refreshments and Game Night
 Purdue Memorial Union: West Faculty Lounge

SATURDAY, March 31, 2012

- 9:00—9:30 am** **Breakfast & Check-in**
 Purdue Stewart Center: West Foyer
- 9:30—10:30 am** **Synthetic Biology with Standardized Parts**
 Karmella Haynes, Ph.D.
 Purdue Stewart Center: Room 322
- 10:45—11:45 am** **Genes as Intellectual Property**
 John Hendricks, J.D., Ph.D., LL.M.
 Purdue Stewart Center: Room 322

Gene Therapy

Mark Kay, Ph.D

Purdue Stewart Center: Room 310

Disclosure of Weaponizable Research

Arturo Casadevall Ph.D

Purdue Stewart Center: Room 314

11:45 —12:45

Lunch

Purdue Stewart Center: Room 218 ABCD

12:50—2:00 pm

The Ethics of Human Enhancement

Linda MacDonald Glenn, JD., LL.M.

Purdue Stewart Center: Room 322

2:15—3:15 pm

The Health and Environmental Impacts of Genetically Modified Organisms

Alan McHughen, Ph.D.

Purdue Stewart Center: Room 322

Personalized Medicine

Michelle Penny, Ph.D

Purdue Stewart Center: Room 310

The Social Impacts of Personal Genetic Information

Meadow Heiman, M.S., LCGC.

Purdue Stewart Center: Room 314

3:20—4:00 pm

Discussion Workshop

Purdue Stewart Center: Room 218 ABCD

4:10—5:30 pm

Panel Discussion “The Role of Biotechnology in the Future of Food Production”

Peter Goldsbrough, Ph.D.

Michael Hall, Ph.D.

George Naylor, B.A.

Purdue Stewart Center: Room 322

Friday March 30, 2012

Reception & Check-in

5:30pm—6:00pm, Union West Faculty Lounge

Check-in and join us in meeting conference speakers, sponsors, Purdue Student Pugwash officers, and other conference attendees. Upon check-in, registrants will receive a nametag, conference t-shirt, and conference materials and information. Refreshments will be served.

Synthetic Life and Society

6:10pm—7:10pm, Union West Faculty Lounge

Jenna Rickus, Ph.D

Associate Professor of Agriculture and Biological, Biomedical Engineering, *Purdue University*

Synthetic biology promises to be a major economic force over the next century. With applications spanning health, energy, agriculture, and the environment, the practice of engineering life will pervade our lives and livelihoods. Though the rewards of engineering biology are great, there are inherent consequences in tinkering with life. The accessibility of biological technology and availability of tools to manipulate life make it ever more important to monitor the progress of this technology. Undergraduates across the world participate annually in the international genetically engineered machines (iGEM) competition to construct artificial functions in living systems through genetic engineering. Even today, a broader range of people are finding Do It Yourself biology workshops in their communities where they can build and test biological parts and devices in living organisms. Professor Jenna Rickus will discuss the social and ethical implications of our increasingly intimate relationship with synthetic biology.

Linking Neurons to Electronics: Implants, Prosthetics, and Beyond

7:15pm—8:15pm, Union West Faculty Lounge

Pedro Irazoqui, Ph.D

Associate Professor of Biomedical Engineering and Director of the Center for Implantable Devices, *Purdue University*

Integrating electronic devices with the body's nervous system holds enormous potential for medicine. Implanted devices can monitor nervous system function and make corrections, helping to control epileptic seizures, for example. Devices can monitor delicate medical conditions in real time, detecting and predicting heart attacks in advance. By decoding nerve impulses from the brain, researchers are developing prosthetics that can be controlled by thought. Other researchers are even uncovering how to reconstruct images and words envisioned in the mind from monitoring brain activity. These new technologies hold enormous potential, but also raise ethical questions as to their use.

Conference Social

8:20pm—10:30pm, Union West Faculty Lounge

Join us for an evening of board games, card games, and socializing with speakers, Pugwash members, and other conference attendees. Refreshments will be provided in the form of assorted wraps, fruit, and drinks.

Saturday March 31, 2012

Reception & Check-in

9:00am—9:30am, Stewart Center West Foyer

Check-in and join us in meeting conference speakers, sponsors, Purdue Student Pugwash officers, and other conference attendees. Upon check-in, registrants will receive a nametag, conference t-shirt, and conference materials and information. A breakfast featuring bagels, croissants, muffins, scones, pastries, fruit, coffee, tea, apple juice, and orange juice will be provided.

Synthetic Biology with Standardized Parts

9:30am—10:30am, STEW 322

Karmella Haynes, Ph.D

Assistant Professor of Biological and Health Systems Engineering, *Arizona State University*

The explosion in molecular biology techniques over the last century has enabled us to direct the operations inside living cells. We can now engineer molecular machines – nucleic acids and proteins – to perform desired functions inside and outside of these biological factories. Scientists have constructed diverse functions in cells previously unobserved in nature, often to mimic the patterns and behavior of electronic devices (logic gates, toggle switches, oscillations, pulsing, signal amplification, and more). The construction of these modular, programmable parts and devices in cells may provide a powerful means to control the behavior of cells in isolation and within multicellular environments. Rational design of these systems has become increasingly feasible as the integration of perspectives in science and engineering further our capacity to rapidly construct, test, and evaluate their performance. Professor Karmella Haynes will speak on how scientists are using molecular biology to build synthetic biological devices.

Breakout Session I

10:45am—11:45am, STEW 322 , 314, 310

STEW 322 - Genes as Intellectual Property

John Hendricks, JD, Ph.D LL.D.

Hitchcock Evert LLP law firm

For the past 30 years, the US Patent and Trademark Office has allowed the issuance of patents relating to DNA molecules. It is estimated that by 2005, The PTO had granted more than 40,000 DNA related patents and that almost 3000 of these have become known as genetic sequence patents ---patents on the composition and information contained in the gene itself. Since the completion of the Human Genome Project in 2002, the practice of allowing patents on genetic sequences has come under attack both on legal and moral grounds. The moral arguments have been both of the utilitarian variety (focusing on the adverse consequences of gene patents on individuals and society) and of the inherent rule based variety (focusing on a moral imperative to treat human beings as ends in themselves and not as means or commodities). Both legal and moral controversies have come to the fore recently in the Myriad Genetics case which concerns the validity of patents covering the gene sequences and mutations in those genes that correlate with a risk of breast cancer. We will use this case as a study of the legal and moral controversy over gene patents and move from there to a discussion of how the principles at play in Myriad may affect controversies over the patenting of living organisms more generally.

Breakout Session I (cont.)

STEW 314 - Disclosure of Weaponizable Research

Arturo Casadevall, Ph.D

Professor of Microbiology and Immunology, *Albert Einstein College of Medicine*
US National Science Advisory Board for Biosecurity

Science is founded on intellectual freedom and the free dissemination of findings throughout the scientific community.; however, some knowledge is inherently dangerous and can be misused in socially harmful ways. For research with potentially dangerous applications, how can the needs for promoting scientific inquiry and protecting the public be balanced? A very recent example of this occurred when several researchers modified the H5N1avian flu to be efficiently transmissible between mammals while remaining extremely lethal. The aim of the research was to determine how the virus might mutate to become transmissible between mammals, but the research could also be used to develop biological weapons. Dr. Casadevall is a member of the U.S. National Science Advisory Board, the body that recommended that these results should be partially censored in the interest of national security. Learn about this decision and how society can best handle such “dual-use research.”

STEW 310 - Gene Therapy

Mark Kay, Ph.D

Professor of Pediatrics-Genetic Therapy, *Stanford University School of Medicine*

Gene therapy and the underlying gene transfer technologies provide a way to treat genetic disorders and acquired diseases in a way that simply could not be done in the past. These technologies use viruses and other vectors to modify the DNA present in a patient’s cells, even replacing mutated genes with healthy genes. Such technologies might even one day be used to treat and cure inherited diseases. The technology has been difficult to develop, but several recent successes show that gene therapy holds tremendous potential. However, testing of these technologies presents some ethical issues. Dr. Kay, a leading researcher in gene therapy technology, will lead a presentation and discussion of this exciting new technology.

Lunch

11:45am—12:45pm, STEW 218 ABCD

Lunch will consist of a pasta buffet, including Caesar salad, garlic bread, cheese tortellini, rotini, eggplant parmigiana, Italian sausage with peppers, focaccia, cannolis, and tea cookies. Coffee, decaf coffee, hot tea, iced tea, lemonade, and ice water will be available to drink.

The Ethics of Human Enhancement

12:50pm—2:00pm, STEW 322

Linda MacDonald Glenn JD, LL.D. Assistant Professor of Medical Education,
Alden March Bioethics Institute; Institute for Ethics & Emerging Technologies

Humans now have it within their power to change the fundamental characteristics of an organism. How, if ever, should we apply this sort of technology to our own species? What are the current ethical rules on human genetic modification and cloning? How much risk would be acceptable in such endeavors? Where is the line between curing a genetic disease and genetic enhancement? In the long term, should humans use genetic engineering and biological modification to direct our own evolution, as the Transhumanism movement proposes? Ponder these vexing questions as this session dives into the ethical complexity of such issues.

Breakout Session II

2:15pm—3:15pm, STEW 322 , 314, 310

STEW 322 - *The Health and Environmental Impacts of Genetically Modified Organisms*

Alan McHughen, Ph.D.

CE Biotechnology Specialist and Geneticist, *University of California Riverside*

A major change in agriculture over the last 20 years has been the development and widespread use of genetically modified organisms (GMOs), organisms whose genetic characteristics have been altered through the insertion of a modified gene or a gene from another, potentially unrelated, organism through genetic engineering techniques. Today, GMO crops such as corn, soybeans, and canola are grown across the United States and can be found in many foods. This technology has been quite controversial, and many potential health and environmental hazards exist. Dr. McHughen, a geneticist, public educator, and consumer advocate who has been involved in crafting regulations regarding GM crops, will address some of these important issues.

STEW 314 - *The Social Impact of Personal Genetic Information*

Meadow Heiman, M.S .

Licensed Certified Genetic Counselor, *Indiana Hemophilia and Thrombosis Center*

The cost and difficulty of sequencing genes and genomes has fallen dramatically over the last decade. In the future, it will be a simple matter to have your genome sequenced and stored as part of your medical and legal record. Today, you can have your genes tested for the presence of inherited diseases and susceptibilities to disease. This information has enormous potential for medicine and for improving quality of life, but also has much potential for misuse. Should an insurance company be allowed to charge you a higher premium or deny you coverage due to the presence of a gene that makes you more susceptible to a health condition, even if the condition is absent? Should potential employers be allowed to consider your genetic predispositions when hiring? With the constant production of hair and dead skin cells, it will not be difficult for entities to determine your genome in the future. How can your private genetic identity be secured? What are your legal rights when it comes to DNA evidence, and what does personal genetic information mean for the legal system?

STEW 310 - *Personalized Medicine*

Michelle Penny, Ph.D.

Senior Director of Pharmacogenetics, *Eli Lilly and Company*

A major shift is occurring in the world of pharmaceuticals as focus is being shifted from developing drugs for general diseases affecting huge populations to developing medicines for more specialized diseases and for much smaller subgroups of the population. The ultimate goal is personalized medicine, i.e. medicine optimized for an individual based on their genes, body chemistry, and other individual traits. Scientific advances in understanding the molecular basis of disease, the technological ability to process and store vast quantities of information, and the socio-economic push for improved patient outcomes have combined to accelerate the development of treatments tailored to individual patients. Dr. Penny will discuss the development and future of personalized medicine, as well as touch on some of the complex scientific, economic, and regulatory challenges of actualizing such medicines.

Discussion Workshop

3:20am—4:00pm, STEW 218 ABCD

This session will occur in the same room as lunch and is intended as a time where you can discuss the issues raised in the breakout sessions and main presentations with other conference attendees. When entering the room, there will be several small tables with Pugwash Executive Board members at each. Pick any table you want and feel free to start discussing any part of the conference with those at the table. Pugwash members will help get the discussion started and will help direct or moderate if needed. We hope that you will walk away from the session with a better grasp of others perspectives and a fuller understanding of what you have learned during the conference.

Panel Discussion “The Role of Biotechnology in the Future of Food Production”

4:10pm—5:30pm, STEW 322

Peter Goldsbrough, Ph.D

Department Head of Botany and Plant Pathology, *Purdue University*

Mike Hall, Ph.D

Commerical Product Definition and Testing Lead, *Monsanto*

George Naylor, B.A.

farmer and past president of the *National Family Farm Coalition (NFFC)*

The United Nations projects that by the end of the 21st century, 3.1 billion additional people will live on planet Earth. Humanity currently utilizes most of the Earth’s fertile land for agriculture, outside of the remaining forests. In a future dealing with climate change, increased soil erosion, soil salinization, and uncertain access to fuel and other resources, how can agriculture succeed in feeding 10.1 billion humans without destroying the environment? Biotechnology is one potential component of meeting this grand challenge, but its widespread use brings with it a host of questions. How will biotechnology, which is typically expensive and developed by a handful of large corporations, impact small farmers and the developing world? What effect would GM crops have on the use of monoculture and on the resilience of the global food supply? Can GM crops decrease the use of pesticides and fertilizers, or cause other environmental benefits? How should the issue of cross-contamination of GM crops with non-GM crops be dealt with in a world of widespread GM crop use? This panel will address these and other questions regarding the role of biotechnology in the future of food production.

Opening Remarks

Peter Meckl, PhD

Professor of Mechanical Engineering at Purdue University, Faculty Advisor to Purdue Student Pugwash

Peter H. Meckl obtained a PhD in Mechanical Engineering from MIT in 1988. He joined the faculty in the School of Mechanical Engineering at Purdue University in 1988. Dr. Meckl's research interests are primarily in dynamics and control of machines, with emphasis on vibration reduction and motion control. His teaching responsibilities include undergraduate courses in systems modeling, measurement systems, and control, and graduate courses in advanced control design, and microprocessor control.

Dr. Meckl was selected as an NEC Faculty Fellow from 1990 to 1992. He received the Ruth and Joel Spira Award for outstanding teaching in 2000. He spent a semester in the Institute of Measurement and Control Engineering at the University of Karlsruhe, Germany in spring 2005, teaching undergraduate control courses and developing a new course in autonomous vehicle control.



Synthetic Life and Society

Jenna Rickus, Ph.D

Assistant Professor of Agricultural and Biological Engineering at Purdue University

Jenna earned her PhD from UCLA in Neuroengineering. While at UCLA she developed new biosensor materials and devices for continuous neurotransmitter measurements. She joined the Purdue ABE faculty in the 2003 and is currently an Associate Professor, with a joint appointment with Biomedical Engineering. Her lab at Purdue is focused on controlling and mimicking cells as an engineered dynamic system. Current research interests include mimicking cellular function in non-living systems to develop advanced and stable biosensors; modeling and controlling neurotransmitter systems at a single cell level. The practical implications of her work span agricultural, biomedical, and food safety applications.

Dr. Rickus has been dually trained in biology and engineering throughout her career. She has a strong interest in new approaches to education that merge the two disciplines in a synergistic manner. She hopes to train a new generation of engineers/biologists who are both comfortable dealing with the complex world of biology and who can think and function quantitatively.



Linking Neurons to Electronics: Implants, Prosthetics, and Beyond

Pedro Irazoqui, Ph. D., Associate Professor of Biomedical Engineering at Purdue University

Dr. Irazoqui received his B.Sc. and M.Sc. degrees in Electrical Engineering from the University of New Hampshire, Durham in 1997 and 1999 respectively, and the Ph.D. in Neuroengineering from the University of California at Los Angeles in 2003.

Currently he is an associate professor in the Weldon School of Biomedical Engineering and in the School of Electrical and Computer Engineering at Purdue University. He is the director of the Center for Implantable Devices pursuing research into a modular approach to the design of biological implants. Devices are applied to the clinical treatment of physiological disorders, using miniature, wireless, implantable systems. Specific research and clinical applications explored include: epilepsy, glaucoma, cardiology, and neural interfaces.

He has received the Best Teacher Award from the Weldon School of Biomedical Engineering (2006 & 2009), the Early Career Award from the Wallace H. Coulter Foundation (2007 & Phase II in 2009), the Marion B. Scott Excellence in Teaching Award from Tau Beta Pi (2008), and the Outstanding Faculty Member Award from the Weldon School of Biomedical Engineering (2009), and has been serving as Associate Editor of IEEE Transactions on Biomedical Engineering since late 2006.



Synthetic Biology with Standardized Parts

Karmella Haynes, Ph.D., Assistant Professor, School of Biological and Health Systems Engineering at Arizona State University

Karmella earned her Ph.D. in Molecular Genetics at Washington University, St. Louis. Her postdoctoral training focused on designing bacterial DNA for mathematical applications (Davidson College) and engineering synthetic proteins to control human cell fates (Harvard Medical School).

Her lab uses synthetic, systems, and quantitative biology to engineer useful gene and protein-based biological devices and to deepen our understanding of molecular cell biology. She operates biological devices primarily in human/ mammalian cells. Accelerating the pace of therapeutic technologies (such as tissue regeneration and customizable protein-based drugs) via modular design is the grand challenge that shapes her research plans.



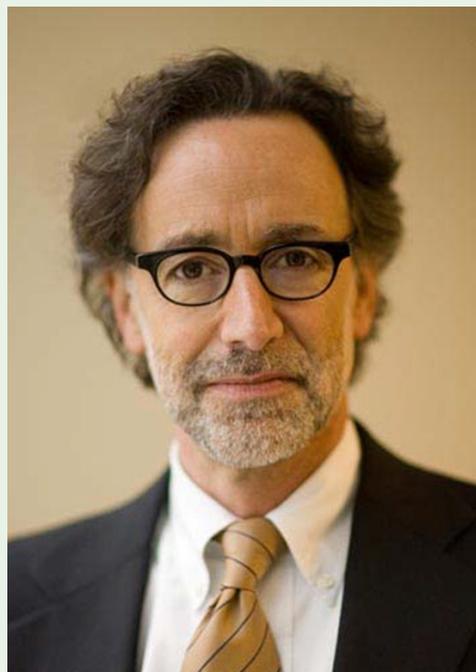
Genes as Intellectual Property

John Hendricks, JD, Ph. D, Hitchcock Evert LLP

John Hendricks specializes in intellectual property litigation, both at the trial and appellate levels. He has represented the intellectual property interests of clients from a broad range of industries, including energy, petrochemicals, computer hardware and software, telecommunications, restaurant holdings and garment manufacturing. John frequently handles high-stakes patent, trademark, and copyright cases, many involving complex intellectual property and antitrust issues and RICO counter-claims, as well as representing both domestic and international clients in international arbitrations. He has led and consulted on numerous state and federal court appeals, including appeals to the U.S. Court of Appeals for the Federal Circuit.

John recently authored an amicus curiae brief filed before the U.S. Court of Appeals for the Federal Circuit on behalf of the March of Dimes and other amici in the matter of *The Association for Molecular Pathology et al. v. Myriad Genetics, Inc. et al.* (Action No. 2010-1406). He has recently filed an amicus brief with the United States Supreme Court in support of Petitioners' request for writ of certiorari in the Myriad case.

Outside of his work in private practice, John has served for a number of years as a tutor and facilitator in the University of Texas Southwestern Medical School's program in medical ethics and is an active participant in a number of organizations at the intersection of medicine and law.



Disclosure of Weaponizable Research

Arturo Casadevall, Ph.D. Professor of Microbiology and Immunology at the Albert Einstein School of Medicine; U.S. National Science Advisory Board for Biosecurity

Arturo Casadevall received his B.A. in Chemistry from Queens College, City University of New York, and his M.S. and Ph.D. in Biochemistry from New York University. He has published over 440 scientific papers and coauthored a book on *Cryptococcus neoformans*. His groundbreaking work in the field of infectious diseases has been recognized by many, including the NIH, which presented him with a Merit Award in 2007. His research is focused on fungal and bacterial pathogenesis and basic immunology of antibody structure-function. A major focus of the laboratory is the fungus *Cryptococcus neoformans*, a ubiquitous environmental microbe that is a frequent cause of disease in immunocompromised individuals. In recent years the laboratory has also worked with other microorganisms including *Bacillus anthracis*, *Mycobacterium tuberculosis*, and *Histoplasma capsulatum*.

He received several distinguished awards, including the Alumni Achievement Award in Basic Science from NYU, the Rhoda Benham Award of the Medical Mycological Society of the Americas, and the Kass Lecture from the Infectious Diseases Society of America. He is currently the Leo and Julia Forchheimer Professor and Chair of the Department of Microbiology and Immunology at Albert Einstein College of Medicine in the Bronx, New York.



Human Gene Therapy

Mark Kay, Ph.D. Professor of Pediatrics –Human Gene Therapy at Stanford University

Dr. Kay received a B.S. in Physical Sciences from Michigan State University, and a Ph.D. in Developmental Genetics from Case Western Reserve University, where he also received his M.D. He worked in several departments at the University of Washington before coming to Stanford in 1998. Dr. Kay has been the Director of the Program in Human Gene Therapy at Stanford from 1998 to the present, and is currently a Dennis Farrey Family Professor and the Associate Chair for Basic Research in Pediatrics.

The goal of the Program in Human Gene Therapy is to develop gene transfer technologies and use them for hepatic gene therapy for the treatment of genetic and acquired diseases. The general approach is to develop new vector systems and delivery methods, test them in the appropriate animal models, uncover the mechanisms involved in vector transduction, and use the most promising approaches in clinical trials. Specifically, Dr. Kay's research group works on a variety of viral and non-viral vector systems. Their major disease models are hemophilia, hepatitis C and B viral infections, and diabetes. The second major focus includes the role that small RNAs play in mammalian gene regulation.



The Ethics of Human Enhancement

Linda MacDonald Glenn, JD. LLN

Assistant Professor at the Alden March Bioethics Institute

Linda MacDonald Glenn (Biomedical Ethics, McGill) is a healthcare ethics educator, counselor-at-law, futurist and international consultant. She holds a faculty appointment at the Alden March Bioethics Institute, Albany Medical Center, and is also a Fellow at the Institute for Emerging Technologies and a Fellow of the American Bar Foundation. Her other honors include an appointment as a Senior Fellow at the American Medical Association's Institute for Ethics, and being named a Women's Bioethics Scholar. Her research encompasses the legal, ethical, and social impact of emerging healthcare technologies, and evolving notions of legal personhood. She has advised governmental leaders and agencies, published numerous articles in professional journals and books, addressed public and professional groups internationally, and made many media appearances, including the History Channel, the Discovery Channel, and NPR. She is currently working on a book titled *Bioethics for a New Earth: How Emerging Technologies Can Change Humankind*.



The Health and Environmental Impacts of Genetically Modified Organisms

Alan McHughen, Ph.D., CE Biotechnology Specialist and Geneticist at University of California Riverside

Alan McHughen is a public sector educator, scientist and consumer advocate. After earning his doctorate at Oxford University, Dr. McHughen worked at Yale University and the University of Saskatchewan before joining the University of California, Riverside. A molecular geneticist with an interest in crop improvement, food safety and environmental sustainability, he helped develop US and Canadian regulations investigating the biosafety of genetically engineered crops and foods. He served on US National Academy of Sciences panels investigating the environmental effects of transgenic plants, another investigating the health effects of genetically modified foods, and served as review coordinator on a recent study into the impact of genetically engineered crops on farm sustainability. Dr. McHughen is currently serving as a Jefferson Science Fellow at State Department, and in the Executive Office of the President, in Washington DC.



The Social Impact of Personal Genetic Information

Meadow Heiman, MS, Licensed Certified Genetic Counselor at the Indiana Hemophilia and Thrombosis Center

Meadow Heiman has been working with the Indiana Hemophilia and Thrombosis Center (IHTC) since 1999. Currently she provides genetic counseling for this non-for-profit organization and has an active role in the center's large research department. Prior to working full-time with IHTC she had the opportunity to work at St. Vincent Hospital in Indianapolis providing both prenatal and pediatric genetic counseling services for a number of years. Ms. Heiman received a BS in Biology from Truman State University and a MS in Medical and Molecular Genetics from Indiana University. She is board certified by the American Board of Genetic Counseling (ABGC) as well as the Academy of Clinical Research Professionals. Ms. Heiman is a member the National Society of Genetic Counselors (NSGC) and is chair of the Hematology SIG. She is also a member of the Indiana Network of Genetic Counselors, National Hemophilia Foundation (NHF), and Academy of Clinical Research Professionals (ACRP). Ms. Heiman is also licensed as a genetic counselor by the state of Indiana.

Ms. Heiman's research activities include studies involving the Indiana Amish community with whom she has been working with for 8 years, as well as pharmaceutical trials and a biorepository. Ms. Heiman has a special interest in the impact medical genetics and new technologies have on health care and society; including the impact on genetic privacy, medical ethics, electronic medical records and familial relationships.



Personalized Medicine

Michelle Penny, Ph.D., Senior Director of Pharmacogenomics at Eli Lilly and Company

Dr. Penny is a Senior Director in the Translational Medicine Group at Eli Lilly and Company. She received her Ph.D. in Genetics from the University of Birmingham, UK in 1993. After a postdoctoral fellowship in the Virology Division at the National Institute of Medical Research, Mill Hill, London, she joined Imperial College London, Department of Medical and Community Genetics where she was a postdoctoral research scientist until taking a lectureship in Human Molecular Genetics in 1998 as course leader for two MSc programs in Human Molecular Genetics with Genetic Counseling. Her academic research career focused on the study of complex polygenic diseases, particularly autoimmune disease and susceptibility to infection. In 2002 Dr. Penny joined the Clinical Pharmacogenomics group at Pfizer in Sandwich, UK, and moved to New London, CT in 2006 to take on the role of Oncology Molecular Medicine Lead until 2009 when she moved to Indianapolis to lead the Pharmacogenomics work at Eli Lilly.



Panel Discussion “Biotechnology and the Future of Food Production”

Peter Goldsbrough, Ph.D., Department Head of Botany and Plant Pathology at Purdue University

Peter Goldsbrough was born in Scotland and obtained his undergraduate degree in Biology from the University of Edinburgh. He then obtained his Ph.D. from the John Innes Institute in Norwich, England. He came to Purdue in 1982 as a postdoc to conduct research on gene expression in maize seeds. He joined the faculty in Horticulture and Landscape Architecture in 1984 and moved to Botany and Plant Pathology as department head in 2006. He has taught an undergraduate class on agricultural biotechnology and the impact of transgenic (genetically modified) crops on agriculture for more than 15 years and has written several articles.

Dr. Goldsbrough’s research is focused on understanding how plants respond and adapt to a variety of environmental stresses, including heavy metals and xenobiotics such as herbicides. His research group is currently focused on examining the functions of phytochelatin and metallothionein ligands in both metal tolerance and normal metal ion homeostasis. The group is also using a genetic approach to understand how plants acquire heavy metals from the soil and regulate the distribution of metals among different tissues. Another area of research involves understanding how plants detoxify certain chemicals to prevent internal damage. One mechanism involves conjugation to glutathione (GSH) and this is catalyzed by a family of enzymes known as glutathione S. transferases (GSTs). In plants GSTs are encoded by a family of approximately 50 genes. His group is interested in learning about the functions of these genes. Their regulation by various environmental factors, and how their genetic manipulation might be used to improve crop plants



Michael Hall, Ph.D. Commercial Product Definition and Testing Lead at Monsanto

Dr. Hall joined DEKALB in 1985 after completion of his Ph.D. in Plant Breeding and Genetics from Purdue University. Monsanto acquired DEKALB in the late 90's, and he has been with the company for a combined 28 years. Dr. Hall has made significant contributions in both native germplasm improvement and transgenic product development.

Dr. Hall entered the industry as a Corn Breeder and Research Station Manager. In this role he developed an array of commercial inbreds and hybrids, and he emerged as a key innovator in breeding methodologies. The use of these lines has resulted in cumulative sales in excess of 40 million units of commercial seed corn across North America and Europe. In addition, the lineages that he developed are still key to Monsanto's portfolio and successful breeding program. In the late 1990's Dr. Hall moved into the realm of transgenic crop improvement as the Director of Transgenic Development for DEKALB and then as the North American Trait Integration Lead for Monsanto. In these roles he was instrumental in building the foundation of the current transgenic breeding program in Monsanto. He was also an important contributor in multidisciplinary product development teams, including those responsible for Roundup Ready Corn, Corn Rootworm, Yieldgard II, High Lysine, and others.



Between 2002 and 2008, Dr. Hall returned to the Breeding organization as Western Line Development Lead and later as the EMEA Corn Breeding Lead. In 2009 Dr. Hall assumed the role of the Director of Trait Development within the Biotechnology organization. This organization is responsible for the evaluation and identification of next generation transgenic products that will create more sustainable and higher yielding crops for the future. He is currently serving the company as the Commercial Product Definition and Testing Lead within Biotechnology. Dr. Hall is a Monsanto Senior Research Fellow and a 2007 and 2008 Edgar M. Queeny Award winner.

George Naylor, Farmer and Past President of the National Family Farm Coalition

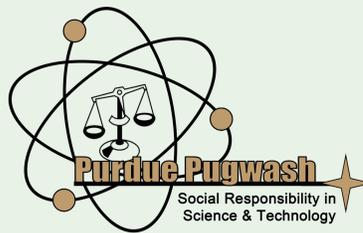
George Naylor has raised corn and soybeans near Churdan, Iowa for 35 years and was a member of the first Iowa Corn Promotion Board in 1978. He has always been involved in various organizations supporting a family farm system of agriculture and is past president of the National Family Farm Coalition. Naylor has been active in Iowa Citizens for Community Improvement and was a member of the board of the Iowa Chapter of the Sierra Club in the early 1990's. He graduated from the University of California at Berkeley.



In 1955, Albert Einstein, Bertrand Russell, and several other eminent scientists issued a manifesto urging scientists and world leaders to “think in a new way” about their moral responsibilities in the nuclear age. The manifesto called on scientists to assemble and discuss the issue of nuclear war as individual members of the human race, and not as representatives of governments or nations. In 1957, a conference was held in Pugwash, Nova Scotia, that brought together some of the greatest scientific minds of the time to address the issues surrounding nuclear weapons and the social responsibility of scientists. This conference was the first in a series of annual conferences that continues to the present day: the Pugwash Conferences on Science and World Affairs.

The mission of the Pugwash Conferences on Science and World Affairs is to bring scientific reason and insight to bear on threats to human security arising from science and technology in general and, above all, from the catastrophic threat posed to humanity by nuclear and other weapons of mass destruction. In recognition of their work toward this goal, Pugwash and one of its founders, Sir Joseph Rotblat, were awarded the Nobel Peace Prize in 1995.

In 1979, two student branches of Pugwash were formed, Student Pugwash USA (SPUSA) and International Student Pugwash. By creating open and objective forums for debate, fostering the exchange of ideas among diverse communities, exploring solutions to current dilemmas in science and technology, and cultivating the analytical skills needed to address future challenges, SPUSA prepares students to make social responsibility a guiding focus of their academic and professional endeavors.



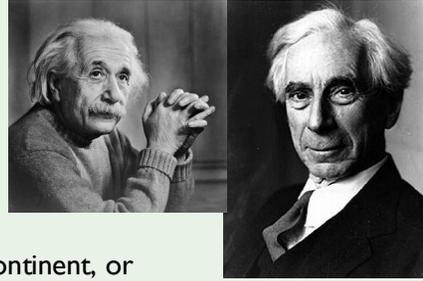
Purdue Student Pugwash is Purdue University’s chapter of Student Pugwash USA. Purdue Pugwash was founded in 1991 by Scott Wright under the faculty direction of Dr. Normand Laurendeau, a retired professor of mechanical engineering. Since then, Pugwash has had a significant impact on the community’s awareness of critical issues by holding events where experts interact closely with students and community members.

Purdue Pugwash is now the most active SPUSA chapter in the United States. During the 2011-2012 academic year, Purdue Student Pugwash has hosted more than 10 speakers for the “Pugwash Presents” lecture series, 7 discussion groups, 3 tours of campus research facilities, 5 hands-on technology building events, and various social events. Most notably, Purdue Pugwash is hosting its seventh annual conference, “Biotechnology: Risks and Rewards of Rewriting Life” and continues to promote community awareness of social and ethical issues in science and technology.

The Russell Einstein Manifesto

Issued in London, 9 July 1955

IN the tragic situation which confronts humanity, we feel that scientists should assemble in conference to appraise the perils that have arisen as a result of the development of weapons of mass destruction, and to discuss a resolution in the spirit of the appended draft.



We are speaking on this occasion, not as members of this or that nation, continent, or creed, but as human beings, members of the species Man, whose continued existence is in doubt. The world is full of conflicts; and, overshadowing all minor conflicts, the titanic struggle between Communism and anti-Communism.

Almost everybody who is politically conscious has strong feelings about one or more of these issues; but we want you, if you can, to set aside such feelings and consider yourselves only as members of a biological species which has had a remarkable history, and whose disappearance none of us can desire.

We shall try to say no single word which should appeal to one group rather than to another. All, equally, are in peril, and, if the peril is understood, there is hope that they may collectively avert it.

We have to learn to think in a new way. We have to learn to ask ourselves, not what steps can be taken to give military victory to whatever group we prefer, for there no longer are such steps; the question we have to ask ourselves is: what steps can be taken to prevent a military contest of which the issue must be disastrous to all parties?

The general public, and even many men in positions of authority, have not realized what would be involved in a war with nuclear bombs. The general public still thinks in terms of the obliteration of cities. It is understood that the new bombs are more powerful than the old, and that, while one A-bomb could obliterate Hiroshima, one H-bomb could obliterate the largest cities, such as London, New York, and Moscow.

No doubt in an H-bomb war great cities would be obliterated. But this is one of the minor disasters that would have to be faced. If everybody in London, New York, and Moscow were exterminated, the world might, in the course of a few centuries, recover from the blow. But we now know, especially since the Bikini test, that nuclear bombs can gradually spread destruction over a very much wider area than had been supposed.

It is stated on very good authority that a bomb can now be manufactured which will be 2,500 times as powerful as that which destroyed Hiroshima. Such a bomb, if exploded near the ground or under water, sends radioactive particles into the upper air. They sink gradually and reach the surface of the earth in the form of a deadly dust or rain. It was this dust which infected the Japanese fishermen and their catch of fish. No one knows how widely such lethal radio-active particles might be diffused, but the best authorities are unanimous in saying that a war with H-bombs might possibly put an end to the human race. It is feared that if many H-bombs are used there will be universal death, sudden only for a minority, but for the majority a slow torture of disease and disintegration.

Many warnings have been uttered by eminent men of science and by authorities in military strategy. None of them will say that the worst results are certain. What they do say is that these results are possible, and no one can be sure that they will not be realized. We have not yet found that the views of experts on this question depend in any degree upon their politics or prejudices. They depend only, so far as our researches have revealed, upon the extent of the particular expert's knowledge. We have found that the men who know most are the most gloomy.

Here, then, is the problem which we present to you, stark and dreadful and inescapable: Shall we put an end to the human race; or shall mankind renounce war? People will not face this alternative because it is so difficult to abolish war.

The abolition of war will demand distasteful limitations of national sovereignty. But what perhaps impedes understanding of the situation more than anything else is that the term "mankind" feels vague and abstract. People scarcely realize in imagination that the danger is to themselves and their children and their grandchildren, and not only to a dimly apprehended humanity. They can scarcely bring themselves to grasp that they, individually, and those whom they love are in imminent danger of perishing agonizingly. And so they hope that perhaps war may be allowed to continue provided modern weapons are prohibited.

This hope is illusory. Whatever agreements not to use H-bombs had been reached in time of peace, they would no longer be considered binding in time of war, and both sides would set to work to manufacture H-bombs as soon as war broke out, for, if one side manufactured the bombs and the other did not, the side that manufactured them would inevitably be victorious.

Although an agreement to renounce nuclear weapons as part of a general reduction of armaments would not afford an ultimate solution, it would serve certain important purposes. First, any agreement between East and West is to the good in so far as it tends to diminish tension. Second, the abolition of thermo-nuclear weapons, if each side believed that the other had carried it out sincerely, would lessen the fear of a sudden attack in the style of Pearl Harbour, which at present keeps both sides in a state of nervous apprehension. We should, therefore, welcome such an agreement though only as a first step.

Most of us are not neutral in feeling, but, as human beings, we have to remember that, if the issues between East and West are to be decided in any manner that can give any possible satisfaction to anybody, whether Communist or anti-Communist, whether Asian or European or American, whether White or Black, then these issues must not be decided by war. We should wish this to be understood, both in the East and in the West.

There lies before us, if we choose, continual progress in happiness, knowledge, and wisdom. Shall we, instead, choose death, because we cannot forget our quarrels? We appeal as human beings to human beings: Remember your humanity, and forget the rest. If you can do so, the way lies open to a new Paradise; if you cannot, there lies before you the risk of universal death.

Resolution:

WE invite this Congress, and through it the scientists of the world and the general public, to subscribe to the following resolution:

"In view of the fact that in any future world war nuclear weapons will certainly be employed, and that such weapons threaten the continued existence of mankind, we urge the governments of the world to realize, and to acknowledge publicly, that their purpose cannot be furthered by a world war, and we urge them, consequently, to find peaceful means for the settlement of all matters of dispute between them."

Max Born

Frederic Joliot-Curie

Joseph Rotblat

Percy W. Bridgman

Herman J. Muller

Bertrand Russell

Albert Einstein

Linus Pauling

Hideki Yukawa

Leopold Infeld

Cecil F. Powell

Dane Sauffer | President

Dane joined Pugwash after being impressed with the 2008 conference, “Energy and the Environment: Powering the Future Responsibly.” He strongly supports Pugwash’s mission of socially conscious science and technology, and greatly enjoys the organization’s atmosphere of objective intellectual exploration. Dane is a senior in Chemical Engineering with a minor in Chemistry. He will graduate in May 2012 and will be working in the Biologics Research and Development Organization for Eli Lilly and Company in Indianapolis. He spent most of his undergraduate career working with Professor Jong Hyun Choi in Mechanical Engineering on several research projects exploring the optical and electronic properties of functionalized nanotubes, quantum dots, and graphene, and is a coauthor of several scientific papers. He has studied abroad in Istanbul, Turkey, and Venice, Italy, and enjoys traveling, hiking, exploring new foods and cultures, and learning about anything and everything.



Jason Stofleth | Treasurer



Jason Stofleth is a senior studying Biochemistry at Purdue. He has been a member of Purdue Student Pugwash for two years, and is the current Treasurer. He joined Pugwash because he enjoyed the opportunity to learn about so many relevant and controversial issues in science and technology with a focus on policy. Jason also conducts undergraduate research in a Structural Biology lab here on campus and is studying one of the protein complexes responsible for electron transfer in oxygenic photosynthesis. He will be attending graduate school at the University of California, San Diego after graduation in May 2012, and plans to conduct research in the biomedical field. When not in class or in the lab, Jason

enjoys keeping up with his aquariums and being outdoors.

Mitchell Scalf | Director of Publicity

Mitchell Scalf is a junior in the school of Chemical Engineering and is also pursuing a minor in psychology. He joined Pugwash this spring and has assumed an active role on the Executive Board, helping especially with publicity and public relations. Mitchell joined Pugwash because of its focus on bringing the technical sciences and liberal arts together through lectures, conferences, and discussions. His plans for the future include working in the commodity resource extraction and purification or waste water treatment industries. He is also a member of Alpha Chi Rho fraternity and the Purdue Outing Club and spends his free time outdoors.





Brian Curnett | Director of Personnel

Brian Curnett is a junior majoring in Chemistry with minors in Forensic Science and Psychology. He became interested in Pugwash after being introduced to it by one of his friends and found Pugwash to be an excellent forum for learning about the broad-reaching implications of the scientific and technological changes that are shaping our world today. Outside of Pugwash, Brian is an active member of the Purdue Forensic Science Club, American Chemical Society, and of Purdue Cyber Forensics.

Sean Kearney | Secretary

Sean Kearney found himself drawn to Purdue Student Pugwash because of its goals in creating a dialogue between science and society. Having worked with Jenna Rickus and Kari Clase as an undergraduate researcher since the spring of 2010, he realized the need for contextualizing science. By engaging our community in an exchange with science, Pugwash encourages responsible decision-making for the good of humanity. Sean is a junior in Biological Engineering and Mathematics with a Minor in Biology. He hopes to work in the field of control and



dynamical systems engineering with applications to synthetic and systems biology. He loves discussing agricultural sustainability, designed ecosystems, and climate change. In his free time, Sean is an avid reader, a half-hearted chef, and an aspiring triathlete.



Robert Winkworth | Technology Coordinator

Robert Winkworth is a doctoral candidate in Purdue's College of Technology, and visiting scholar in the Center for Education and Research in Information Assurance and Security (CERIAS). A respected instructor and developer with multiple honors and over 15 years of experience in live cyber-security cases, he has served on dozens of panels and task forces, organizing and inspiring others to work toward interdisciplinary goals, and brings to Pugwash a focus on the use and abuse of information systems in personnel security. His work in electronic evidence preservation

Has included the establishment of new laboratory facilities at Purdue, and their use in live criminal investigations. He has worked extensively with wireless systems and electronics, and teaches several topics related to technology and society. His most recent research has involved the development of microcontrollers, intelligent systems, and radio frequency identification.

Alex Webster | Executive Council

Alex is a graduate student pursuing a PhD in nuclear engineering. His research is in neutron detection for the purpose of preventing the illicit trafficking of special nuclear materials. His current career interest is in nuclear fuel security. He has been in Pugwash for six years and is a past President. Alex appreciates how Pugwash provides the opportunity to learn about science and social issues, especially ones far outside his field of study. Upon entering a field of work that is highly dependent on safety and positive public opinion, the practice of critical analysis encouraged by Pugwash is necessary.



Jessica Holsinger | Executive Council

Jessica Holsinger joined Purdue Student Pugwash 7 years ago as a favor to a friend. The small club had a loyal core of participating members, but was struggling to build a presence on Purdue's large campus. She volunteered to help design flyers to advertise for the club. After a few events, she grew to love Pugwash for the opportunities it provides for learning outside her area of study. She has served multiple terms as an officer, including Director of Public Relations and Vice President, in addition to serving on the national Board of Directors for Student Pugwash USA. Jessica is working towards a dual-degree, studying Purdue's Aerospace Engineering and Biology curricula. She plans to eventually do research in the field of bioastronautics, an area concerned with the study and sup-

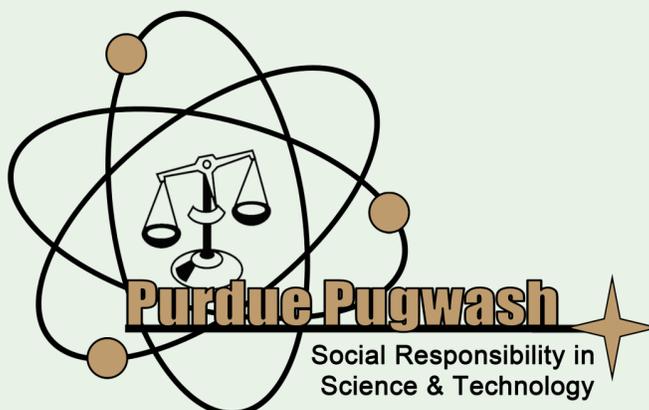


Brittany Kleefisch | Director of Programming

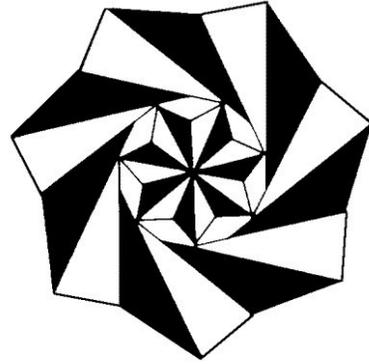
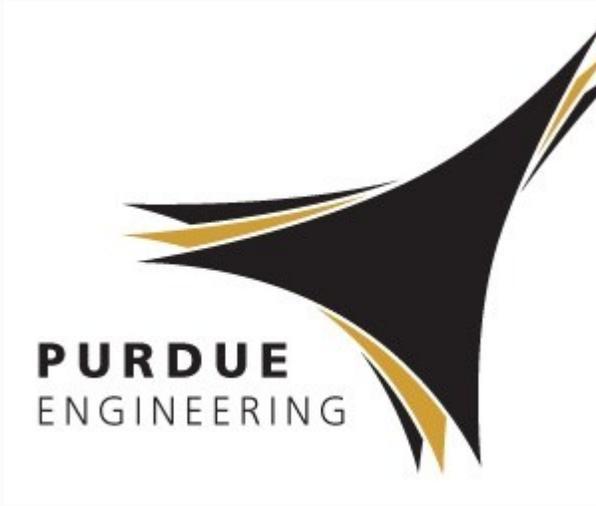
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Tushar Sinha | Executive Council

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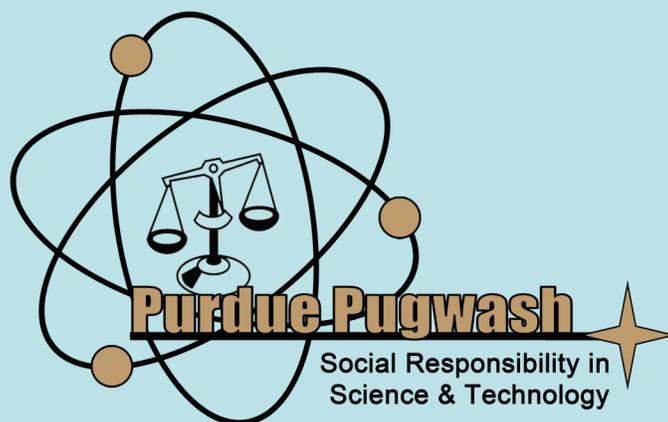


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