

Bears Breaking Boundaries 2008 Fact Sheet:

Computational Nanoscience Innovation:

1st place, \$5,000 - Surface and interface effects on nanoscale systems by Erik Garnett (Department of Chemistry) - This project examines how different atoms on the surface of nano materials affect their electrical, optical, and thermal properties.

2nd place, \$2,500 - Tool for Experimental Characterization Validation via Simulation Fitting (ECVSEF) by Kristie Koski (Department of Chemistry) - This tool compares experimentally measured data on nanoparticles to theoretical calculations, to answer the age-old question, "What on earth am I looking at?"

3rd place, \$1,500 - Molecular Electronics Model, Semiconductor Nanocrystals by David Strubbe (Department of Physics) - Molecular electronics is a growing field of research that is trying to understand the flow of electricity through small molecules, with the eventual goal of using these molecules as components in future nanoscale circuits. These could be used in making computer chips or sensors. Quantum dots are nanosized crystals of semiconductor materials which are currently used as fluorescent labels in biomedical research and have potential applications in lasers and other optical and electronic devices. Simple models are proposed that can calculate the electrical conductance of molecular junctions and the optical and electronic properties of quantum dots. These models can be used to gain physical insight into the results of experiments or more sophisticated theoretical calculations.

Honorable Mention, \$1,000 - A Computational Tool for Exploring Residual Strains in Nanostructures by Cathy Hu and P. Alex Greaney - This tool will analyze the effects of stresses and strains on nanostructures to allow enhanced computed simulations of nano particles.

Honorable Mention, \$1,000 - Exploring the Necessity of Quantum Mechanical Simulations on Nanoscale Materials by Devesh Khanal (Department of Materials Science and Engineering) - An internet based simulation tool that will calculate nano scale material properties using both classical and quantum physics. The results will be stored in a database for users to quickly look up simulations done on materials with similar dimensions as theirs and compare the accuracy of the two approaches.

Curricular Innovation:

1st place, \$10,000 - CleanTech Solutions course by Sarah Barker-Ball, Max Baumhefner, Avery Cohn, Howard Chong, Jerome Fox, Louise Gibbons, Joseph Levin, Michael Martin, Maria Schriver, Ryan Stanley (Boalt Hall Law School, Haas Business School, College of Natural Resources - Environmental Science Policy and Management, Economics - Agricultural and Resource Economics, Chemical Engineering, School of Public Policy, Mechanical Engineering) - An interdisciplinary graduate course providing students the opportunity to work with clients from companies, governmental entities, and nonprofits to solve real-life problems in energy and environmental issues through first-hands research, case study writing, networking, and presentation.

2nd place, \$5,000 - Sustainability Breadth by Kelley Payne McKanna (Environmental Economics and Policy) and Aditya Rohilla (Environmental Science, Energy and Resources) - An undergraduate breadth requirement analogous to the American Cultures requirement to ensure that all graduates have an elementary understanding of sustainability. This requirement will also engage students in a campus-wide dialogue about how to address pressing issues such as climate change, resource scarcity, and environmental justice.

3rd place, \$3,000 - Introduction to Coupled Human and Natural Systems by Iryna Dronova (Environmental Science, Policy, and Management Department) - An interdisciplinary graduate course designed to help students develop an understanding of human and nature interactions as simultaneous and mutually interacting processes that generate new properties not evident when these systems are studied separately.

4th place, \$2,000 - New minor in Food Systems & Sustainability by Albie Miles and Nathan McClintock (Environmental Science, Policy, and Management Department, Geography) - The Food Systems & Sustainability minor will provide a formal infrastructure and academic recognition for UC Berkeley students interested in the critical social, political, economic, environmental, and public health issues facing contemporary food and agriculture systems. The minor will offer theoretical coursework, individual research, and experiential service-learning.

Energy and Environmental Innovation:

1st place, \$7,000 - The Use of New Financing Tools to Increase Residential Energy Efficiency by Merrian Fuller, Ian Kim, and Alice LaPierre (Haas School of Business, Energy and Resources Group, Ella Baker Center for Human Rights, City of Berkeley) - This team will conduct a study on existing best practices in energy efficiency and will work with the City of Berkeley to design a program to finance energy efficiency using bonds that will be repaid through the homeowner's property tax bill over 20 years, which has never been done before. The team will create a workshop for decision makers from

government, utilities, and NGOs interested in designing and managing their energy efficiency programs using best practices and new financing tools.

2nd place (5 at \$4,000 each) -

- Coupling wind generators with flexible loads: a proposal for large scale integration of renewable energy by Anthony Papavasiliou, Mauricio Junca, and Thomas Dickhoff - A significant proportion of the energy we consume is dedicated to duties which are not time specific (think of dishwashers, dryers and laundry). This proposal suggests that renewable generators control a group of loads remotely, and supply power within a not completely predictable yet reasonable amount of time.
- Guatemala Solar Hot Water Heater by Sara Al-Beaini, Alissa Johnson, Kenneth Armijo, Merwan Benhabib, Yang-Yang Chen, Howdy Goudey, Adam Langton, Samantha Engelage, Ernesto Rodriguez (Mechanical Engineering - Heat transfer and design, Environmental Engineering - water quality, Materials Science Engineering, Goldman School of Public Policy, Haas School of Business) - This team is developing an affordable residential solar hot water system for developing countries. The system will be constructed using local materials and labor to minimize cost and maximize impact. Prototypes have been developed for households of the city of Quetzaltenango, Guatemala and additional field testing, surveys, and design changes are in the team's future plans.
- Fabric Recycling for Alameda County Residents by Noelle Cole(Landscape Architecture and City Planning) - This proposal will consist of an in-depth review of the potentials for residential fabric recycling and a program for its implementation in Alameda County.
- Berkeley Green Campus Program by Kameron Kitajima, Shanw Orgel-Olson, Jessica Huang, Erin Martin (Civil and Environmental Engineering (COE), Haas School of Business, College of Natural Resources, Energy and Resources) - The Berkeley Green Campus program strives to educate students, staff, faculty, and the local community about the importance of energy conservation and achieve substantial energy savings by implementing projects on the main campus and in the residence halls.
- BERC Innovative Solutions by Sarah Barker-Ball, Max Baumhefner, Avery Cohn, Howard Chong, Jerome Fox, Louise Gibbons, Joseph Levin, Michael Martin, Maria Schriver, Ryan Stanley(Haas School of Business, School of Law - Boalt Hall, Environmental Science Policy and Management(CNR), Chemical Engineering, Goldman School of Public Policy, Department of Mechanical Engineering) - A proposed graduate solutions center, managed by the Berkeley Energy and Resources Collaborative and its strategic partners - that will leverage the reputation and myriad resources of UC Berkeley to pioneer innovative, implementable solutions to the problem of climate change from multiple perspectives through engagements with clients from industrial, political and commercial sectors on a project-by-project basis.

3rd place (7 at \$2,500 each) -

- Reducing Residential Energy Consumption through Metering, Monitoring, and Control Technology by Benoit Bouvard, Jon Burns, Kaan Ersun, Xiaofan Jiang, Shepherd Smith, Jay Taneja (Haas School of Business, College of Engineering(Computer Science) - This technology will bridge the information and control gap of electricity consumption in the home by giving consumers the ability to monitor and manage their electricity consumption at the appliance level.
- Emerging technologies lifecycle design tool: biofuels by Avery Cohn, Sebastian Humbert, Shufei Lei, Sally Maki, Corrine Scown (Environmental Science, Policy & Management (CNR), Civil and Environmental Engineering (COE), Energy and Resources) - The use of lifecycle assessment to measure the environmental impacts of biofuels is growing in its sophistication and application. Yet, the biofuels industry itself still rarely if ever uses lifecycle assessment (LCA) to inform technological development and design. This award brings together an interdisciplinary team of UC Berkeley graduate students to consider creating a web-based, LCA driven decision making tool for emerging technologies/biofuels.
- China Environmental Governance Database by Christopher Williams (School of Law, Boalt Hall) - The internet does not yet offer professionals in the clean-tech, green jobs, and environmental management policy fields a centralized source for information on China's environmental and energy policy structure, clean-tech investment markets, or project development practices. The main goal of this project is to build such a database.
- LEEDing Boalt by Erica Schroeder, Heather Matsumoto, Christopher Williams (Boalt Hall School of Law) - This team is committed to seeing that the new building at Boalt is sustainable, energy-efficient, and LEED-certified.
- Plugging in Bacteria by Heather Jensen (Department of Chemistry, Molecular Foundry - LBNL) - This proposes engineering photosynthetic microbes, the most efficient light energy harvesters, to connect the living and electronic world through a single common language: electrons.
- Helixair by Jesse Leaman and Justin Guyer (Department of Astronomy) - A working prototype that combines a vertical axis wind turbine, solar panel, voltage controller, onboard battery, and optional electrical components such as LED lights or surveillance cameras. The goal of this project is to reduce society's energy consumption and reliance on a fragile central energy grid that produces most of its power by burning fossil fuels.
- Deep Sea Energy Generation by Kenneth Armijo, Annabelle -Louie and Kunal Nagpal (Haas School of Business, Department of Mechanical Engineering) - While land-based geothermal power (energy generated by heat stored beneath the Earth's surface) is generated in over 20 countries around the world, ocean thermal conversion technology, an energy technology that converts solar radiation to electric power, has largely been underdeveloped due to two main obstacles: 1) the low efficiency that is achieved relative to existing renewable energy technologies;

and 2) the costs and regulatory constraints of building ocean thermal plants. Our model's innovation will address these two problems while also creating a positive feedback loop to increase environmental sustainability.

Idea Labs:

This year, Bears Breaking Boundaries awarded multidisciplinary teams of graduate students to collaborate over shared interests in topics such as:

- Characterization and Imaging of Single Molecules and Assays CHARISMA by Hagar Zohar (Chemistry, Chemical Engineering, Mechanical Engineering, BioEngineering, Physics) - multidisciplinary approaches to the application and elucidation of biological functions. Collaboration will promote mutual success in applications as diverse as single-molecule genotyping, point-of-care disease diagnostic assays, and fundamental biopolymer dynamics studies.
- Energy Efficiency and Conservation by Merrian Fuller, Sam Borgeson, Jit Bhattacharya, Zach Levine, Avery Cohn, and Benoit Bouvard (Energy and Resources Group, Haas School of Business, Industrial Engineering and Operations Research, Environmental Science Policy and Management, Agricultural and Resource Economics, Boalt Hall School of Law) - research and careers related to Energy Efficiency & Conservation. Particular interests of this group include behavior change, energy financing, entrepreneurial opportunities in EE&C, and effective policy to encourage EE&C.
- Berkeley Water Idea Lab by Zachary Burt, Ashley Murray, Emily Kumpel, and Charlotte Smith (Energy and Resources Group, Civil and Environmental Engineering, Public Health) - water, sanitation and hygiene. Most participants are engaged in projects aimed at less developed countries, but the group is open to engaging problems found in developed countries as well.
- Green Collar Jobs by Sarah Barker-Ball, Sunil Bector, Avery Cohn, Merrian Fuller, Christopher Williams (School of Law - Boalt Hall, Environmental Science Policy and Management, Haas School of Business) - a launching pad to establish long-term relationships with bay area centers devoted to the Green Collar Job movement, as well as with local city governments as they implement policies affecting the Green Collar economy to assist in their social and political efforts. The group intends to combine their collective research and connections to create a document outlining the different ways UC Berkeley community members can get substantively involved in and contribute to the Green Collar Jobs movement.
- POC-Dx by Tanner Nevill, Frankie Myers, David Liang, Octavian Florescu, and Rich Henrikson (Bioengineering, Computer engineering) - developing point of care diagnostic systems (POC-Dx), small, inexpensive, and portable medical systems to diagnose neglected diseases in developing countries. Related topics will include epidemiology, developing world healthcare structure, infectious disease, existing diagnostic methods, and business sustainability.

- Better Blocks by Kyle Konis, Jon Mingle, Ellen Chen, Ling Huiling, Patricia Decker (School of Architecture, Energy and Resources, Goldman School of Public Policy, Haas School of Business, Structural Engineering, Mechanics, and Materials - Civil and Environmental Engineering) - the design, evaluation, and implementation of low-cost, highly-insulating, earthquake-resistant construction techniques for seismically endangered communities, with the goal of improving the methods of construction currently used by the most resource-constrained citizens.
- Microbial Biofuels by Matthew R. Melnicki, Dara B. Goodheart, Jerome Fox (Agricultural and Environmental Chemistry, Plant and Microbial Biology, Chemical Engineering) - the envisioning of diverse strategies that microbiologists may use to contribute towards the advancement of biofuel technologies.
- Rural Electrification in the Developing World by Jon Mingle and Josiah Johnston (Energy and Resources, Mechanical Engineering, Haas School of Business) - ways to increase access to electricity for communities in the developing world.
- UC Information Studies by Megan Finn, Dan Perkel, and Christo Sims in collaboration with Lilly Nguyen and Lilly Irani (UC Berkeley School of Information, UCLA Department of Information Studies, UC Irvine Department of Informatics) - a community of doctoral students in the general field of information studies in the University of California system with the shared objectives of understanding the role of information technology in society, through approaches spanning a range of social science, humanities, and engineering fields.
- Green Policy Innovations by Avery Cohn et al (Environmental Science, Policy and Management, Goldman School of Public Policy, Energy and Resources, Anthropology, City and Regional Planning) - graduate student work at the nexus of environmental problem-solving and emerging technologies, drawing from sociology, business and management studies, law, organizational studies, political science, anthropology, city and regional planning, public policy and environmental policy analysis to apply perspectives from social science disciplines to important debates about green innovation.

Improving Student Life:

1st place, \$10,000 - The Green Bike Share Project by Marcelo Felipe Garzo Montalvo and Justin Jay Wiley (College of Letters and Science - Ethnic Studies, College of Natural Resources - Conservation and Resource Studies) - The Green Bike Share (GBS) program will give students affordable, environmentally sustainable, and increased access to bicycles.

2nd place, \$6,500 - Creating a Standardized XML Model of Students to allow extensibility and new services to be built on top of legacy infrastructure by Eun Kyoung Choe, Michael Lee, and Seung-Hyun Rhee (UC Berkeley School of Information) - This team will develop a new, standardized XML information infrastructure for the array of legacy systems on the UC Berkeley campus to provide new services and functionality for students.

3rd place, \$3,500 - Dean's TEAM by Maggie Dunbar and Janet Choi (Interdisciplinary Studies, Environmental Economics and Legal Studies) - This student-run training program will equip student facilitators with the knowledge, skills, and experience they need to effectively design workshops, retreats, and team building experiences for the 800+ student groups on the UC Berkeley campus.

IT For Society:

1st place, \$15,000: Minimally Obtrusive Wearable Device for Continuous Interactive Cognitive and Neurological Assessment by Antoni Ivorra, Charlotte Daniels, and Boris Rubinsky (Department of Bioengineering and Department of Mechanical Engineering, UC Berkeley, Center for Bioengineering in the Service of Humanity and Society, School of Computer Science and Engineering, Hebrew University of Jerusalem) - This project will develop a wearable device to continuously assess the cognitive capability of people with diseases such as Alzheimer's.

2nd place, \$7,000: Integrated Diabetes Management by Christopher Hannemann and Sarah Beth Eisinger, UC Berkeley (Department of Mechanical Engineering, Department of Electrical Engineering and Computer Science) - This project will assess the technical and market feasibility of a system integrating glucometers and insulin pumps with wireless data transmitters, wireless mobile devices (such as smart phones), personal computers, and a web-based records database.

3rd place, \$5,000: Coupling Wind Generators with Deferrable Loads by Anthony Papavasiliou, Shmuel Oren, Mauricio Junca, Alex Dimakis, and Thomas Dickhoff, UC Berkeley - A significant proportion of the energy we consume is dedicated to duties which are not time specific (think of dishwashers, dryers and laundry). This proposal suggests that renewable generators control a group of loads remotely, and supply power within a not completely predictable yet reasonable amount of time.

In addition to the top three prizes, there were three honorable mentions, who each received \$1000 to support their work:

1) Game-Based Disaster Emergency Response Training by Kenneth Hullett, UC Santa Cruz - Our idea is to develop a training game for teaching collapsed structure rescue skills to members of emergency response community. The trainee will specify which skills they want to train, and the game will create a unique scenario that contains the appropriate challenges.

2) Bringing Reliable Power and Mobile Communication to West Africa to Improve Emergency Obstetric Care by Laura Stachel, Christian Casillas, Melissa Ho, Hal Aronson, and Andrew Sproul, UC Berkeley (School of Public Health, Energy Resources Group, School of Information, Solar School House, Adax) - We propose a “proof of concept” project to demonstrate the impact that reliable power and communications will have on addressing problems of sporadic supply electricity in rural northern Nigeria. We will design and install a photovoltaic energy system retrofit to power lighting, medical

equipment and communication equipment in a major municipal hospital.

3) Application of Bayesian Networks to Infrastructure Risk Management by Michelle Bensi, Armen Der Kiureghian, Daniel Straub, UC Berkeley

The project team is developing a decision-support system for emergency response, recovery prioritization, and risk-management efforts relating to civil infrastructure systems. Ultimately, a prototype decision-support system that integrates advances in information technology, computer science and civil engineering will optimize decision-making in near-real time under uncertainty and with limited and evolving information.

Neglected Diseases:

1st place, \$5,000 - Modular Riboswitch Diagnostics by Rick Henrikson, Hangsang Cho, and Frankie Myers (UCSF/UC Berkeley Bioengineering) - This project will consider using molecules called riboswitches to diagnose diseases (e.g. tuberculosis) in developing countries. Riboswitches are specialized nucleic acids that can be designed to bind to target molecules with high sensitivity and selectivity. This binding event leads to downstream signals that can be readily detected on a microfluidic lab-on-chip platform.

2nd place, \$4,500 - Survey of the Prevalance of Rickettsia prowazekii by Jennifer Wai Yan Quan (Department of Environmental Science, Policy and Management - Molecular Environmental Biology) - This project will create a program to survey and control the prevalence of lice infestations in orphanage children in Kathmandu Valley, Nepal.

Science, Technology, and Engineering Policy:

1st Place (tie), \$1,500 - Mitigating the Oil Crisis: Coal-to-Liquid Technology for American Energy Independence by Brian Kessler and Gavi Begtrup - The ballooning price of oil and increasing dependence on foreign imports has led to an American liquid fuels crisis. Although clean fuels and alternative energy sources hold great promise for the future, they are not yet ready for large scale integration. Coal-to-liquid (CTL) technology is a promising possibility. We advocate federal policies to promote initial installations that will develop both the technology and economics of CTL: a sliding-scale federal tax subsidy for CTL fuel, federal loan guarantees for plant construction and federal grants for research bridging CTL technology to renewable replacements.

1st Place (tie), \$1,500 - Promoting Pharmaceutical Research under National Health Care Reform by Jacob Heller and Gabriel Rocklin - The pharmaceutical industry is suffering a productivity crisis, brought on by soaring R&D costs and competition with generic manufacturers. Upcoming health care reforms in the US will curtail the remaining incentives for pharmaceutical research, but also provide us an opportunity for rebuilding a more efficient set of research incentives. To maintain robust incentives for medical research and to cure defects of the patent system, we propose a National Pharmaceutical Innovation Fund. By setting proper incentives, the Fund marshals private sector efficiencies, expertise, and resources to innovating improvements in medical treatments.

2nd Place, \$1,000 - Privacy Concerns in Personal Genomics by Dov Greenbaum - The President, as expected, recently signed the Genetic Information Nondiscrimination Act (GINA) into law. This bill will hopefully shield much of the public from genetic discrimination. The bill, however, will fail to effectively protect the privacy of consumers of the personal genomics industry which has only just recently emerged. This paper compares personal genomics to the Web 2.0 phenomenon, noting in particular the propensity of users to unashamedly share their (and often their friend's) personal data -- effectively contributing to the erosion of online privacy. With the concern that over-regulation of the industry will chill the important collection of genomic data, this paper proposes a number of suggestions that could easily be implemented by the nascent personal genomic industry to reduce these privacy concerns, yet retain the flexibility necessary to nurture the underlying science and technology.

3rd Place, \$500 - Patentright Licenses: Open-source Licensing for Patented Technologies by Jessica Richman - The number of patent filings per year in the US has quadrupled since 1980. At the same time, patentable subject matter has expanded to include business methods, computer algorithms, and genetic material. This vast growth in the number and scope of patents reflects not only technological advances but also inventor strategies that boost individual patent value at the expense of overall innovation. Building on the legal framework provided by copyleft licenses, such as open-source software and the Creative Commons, I have coined the term "patentright" to represent a similar approach based on patent law. Patentright licenses would provide a convenient way for inventors to selectively license their innovations and build upon others' creations for the common good.

Travel Grant, \$500 - Brian Kessler and Gavi Begtrup - Brian and Gavi plan to travel to Washington, DC to meet with Sen. Dorgan and Bunning and Rep. Boucher to discuss current legislation on Coal-to-Liquid Technology. They also plan to speak with Sen. Boxer and Feinstein and Rep. Lee to discuss the relevance of CTL technology to California.

Social Innovation:

1st place, \$8,000 - Arsenic Free Water in Cambodia by Jessica Huang, Susan Amrose, Deborah Cheng, Michele Itten, Marianna Kowalczyk, kristin Kowolik, Marc Muller, John Wang (Physics, Energy and Resources, Civil Engineering & Business, Mathematics, Environmental Engineering, Chemistry) - This group is developing and implementing a low-cost electro-coagulation system to remove arsenic from contaminated groundwater in Kandal Province, Cambodia. In electro-coagulation, electricity is used to continuously dissolve iron, forming arsenic-binding corrosion products (ABCP) such as ferric hydroxides, ferric oxyhydroxides, and ferric oxides (collectively called ferric (hydr)oxides or rust). One advantage is that the arsenic adsorbent is manufactured at the time of use, eliminating the need for a costly supply chain.

2nd place, \$6,000 - Sierra Leone by Peter Maybarduk, Jamie O'Connell, Mohammed Abdul Basit Khan, Stephanie Weber, Khalid Kadir, Ian Mountjoy (School of Public Health, Environmental Engineering) - This team of Berkeley students will collaborate with Sierra Leone's Minister of Foreign Affairs and International Cooperation, Zainab Bangura, and government agencies in Freetown, Sierra Leone to implement good governance reforms for the country of Sierra Leone.

3rd place, \$4,000 - Village International by Benn Eifert, Robert Van Buskirk (Department of Economics, Center for Evaluation of Global Action, Lawrence Berkeley Laboratories, Village Projects International) - This partnership between Village Projects International and Benn Eifert, an economist and impact evaluation specialist, will advance VPI's vision of creating markets for verified social and environmental impacts generated by projects in developing countries, such as carbon markets reward verified reductions in carbon emissions. Eifert will work with VPI to develop a streamlined rigorous evaluation framework to measure and price social and environmental impacts and implement such markets in pilot form in two hundred villages across four African countries.

4th place, \$2,000 - Magnolia Project by Joseph Guzman, Alice Chamberlain, Christa Lim, Nuru Abdu, Jessica Fabro, Ali Glenesk (Development Studies, Environmental Economics and Policy, Business Administration, Architecture, Arabic, Philosophy and Economics) - This project will expand UC Berkeley's education, service and advocacy efforts to rebuild the Gulf Coast following the destruction of Hurricane Katrina.

Synthetic Biology:

1st place, \$5,000 - Synthetic Platelets by David Richmond, Wilbur Lam, Ross Rounsevell, Benjamin Rhau (Bioengineering, Biophysics (UCSF) - This project will design synthetic "platelets" - the blood cells responsible for clotting - for patients suffering from cancer or major blood loss.

2nd place, \$3,000 - Synthetic Biology for the Developing World: A Partnership Between SynBERC and the Peace Corps by Andrew Horwitz, Alexander Watters, Angela Chau, Daniel Mandell (Department of Cellular and Molecular Pharmacology, UCSF, UCSF/UCB Joint Graduate Group in Bioengineering, Biological and Medical Informatics Program, UCSF) - This team will organize a yearly retreat in which Peace Corps volunteers and Synthetic Biologists meet to identify challenges of the developing world that might be addressed through synthetic biology (water purification, agriculture, waste remediation etc). These challenges will be formatted into requests for proposals, and funded through a competitive application process.