

May 15, 2007

Bears Breaking Boundaries 2007 – Award Recipients

Bio-Inspired Innovation

1st place (\$10,000) - Biologically-inspired Microfluidic Silk Spinning, submitted by David N. Breslauer: The research proposed herein constitutes the development of a microfluidic device for micro- and nano-fiber formation that directly mimics the complexity of *in vivo* arachnid silk spinning organs. The microfluidic device will be able to generate silk fibers with mechanical properties comparable to those produced *in vivo*, in benign environments, by controlling the structure and properties of the fiber as it is being formed.

2nd place (\$5,000) - Sticking Like a Mussel: Designer Biomimetic Adhesives, submitted by Eddie Wong: Among the best characterized biological adhesives are the mussel foot proteins (mfp). These strong and flexible glues securely fasten mussels in turbulent tidal zones. Researchers are studying the mechanisms of these proteins but have been severely hampered due to difficulties associated with obtaining samples and controlling the protein chemistries. This paper describes a method to overcome these hurdles via controlled microbial synthesis of mfps and mfp-like proteins. The success of this method may lead to the development and production of environmentally friendly, designer bio adhesives with possible applications in a variety of fields including medicine and biotechnology.

Curricular Innovation

1st place (\$5,000) - Modern Slave Trade, submitted by Judge Hensley: The course that our team would like to see offered is one that focuses on the issues of the Modern Slave Trade. Most people think of slavery as something that was abolished in the 19th century by Abraham Lincoln, but the sad fact is that slavery has continued through the twentieth century and is thriving today. Modern slavery is an umbrella term that encompasses many different aspects including the sale and trafficking of human beings (either for sexual exploitation or manual labor), the abduction of children by rebel groups in Africa for use as child soldiers and trans-generational debt bondage in nations such as India. With more than 800,000 people trafficked throughout the world every year, modern slavery is on the rise and is thriving in part due to the economic revolution sweeping through South and Southeast Asia. We believe a course that focuses specifically on these issues is essential in order to bring to light a hidden and largely unknown blight in our world.

2nd place (\$3,000) - Social Entrepreneurship In Practice (SEIP): Leveraging UC Berkeley's diverse talent to promote social change, submitted by Mike Pearce, Jason Kibbey, Matt Evans, Luke Dunnington: We propose creating a series of new courses that would be focused on the *practice of social entrepreneurship*. Fundamental to these courses would be bringing together cross functional teams composed of students from different schools at both the undergraduate and graduate levels to learn the unique challenges and gain hands-on experience in social entrepreneurship. Our coursework would include a “core” class in which students would receive an overview of the emerging field of social

entrepreneurship from both instructors and practitioners. Following the core class, students could move onto one of two follow-up classes: Social Entrepreneurship Consulting (SEC) or Social Entrepreneurship Funding (SEF).

3rd place (\$2000) - Battery Technologies: Addressing the Growing Demand for Electrical Energy Storage, submitted by Paul Albertus, Ilan Gur, Venkat Srinivasan: There is widespread current interest in energy innovation and technology for a number of reasons, including climate change, energy security, pollution, and volatile energy prices. Current interests in addressing these problems fall into a number of different categories, including energy generation, energy demand management, efficiency improvements, energy conversion, and energy storage, among others. A number of courses at UC Berkeley address the challenges in these categories; for example, there are courses on energy markets and fuel cells, on the electrical grid and on combustion. However, among these course offerings there is a notable lack of attention given to energy storage. In fact, although many researchers and commentators frequently stress the importance of energy storage in the broader story about energy, there is no course at UC Berkeley on energy storage. And, while there are many forms of energy storage, including mechanical (e.g., flywheels, pumped hydro) and chemical (e.g., biofuels), the most important form of energy storage today is electrochemical batteries. We therefore propose a course that focuses on batteries for electrical energy storage.

Global Poverty Reduction

1st place (\$10,000) - Berkeley Arsenic Alleviation Group, submitted by Johanna Mathieu, Tasnuva Khan, Kosar Jahani, and Mehmet Seflek: The Berkeley Arsenic Alleviation Group is an interdisciplinary team composed of four students—one graduate student and three undergraduates—studying engineering, business, and economics respectively. Our goal is to design a process that utilizes ARUBA, Arsenic Removal Using Bottom Ash, a material developed by scientists at the Lawrence Berkeley National Lab to effectively and affordably remove arsenic from groundwater in rural Bangladeshi communities. In addition, we are developing a business plan for the implementation of the proposed process. Our technology and business plan aim to benefit poor Bangladeshis in rural villages, while still realizing a profit for the business, as financial sustainability is the key to long-term success.

2nd place (\$5,000) - Poverty Reduction in Panama, Reducing the use of disposable batteries in a Ngobe village, submitted by Kimberly Lau, Anna Zaniewski, and Jed Duersch: We are launching a project to decrease the cost of light in Soloy, Panama, where families spend a large portion of their income buying disposable batteries to power flashlights. If we reduce the amount of batteries that are bought, we increase disposable income. Thus by making the flashlights significantly more efficient, we have an effective poverty reduction program. The flashlights that are currently being used have an incandescent-type lightbulb. Such a lightbulb is grossly inefficient, especially compared to the latest technology, white light emitting diodes (LED). We therefore decided to retrofit the flashlights already used by community members with the efficient LED bulbs. This has the potential to save families \$80 or more per year, a significant saving in a region where people typically live on \$1 - \$2 a day.

3rd place (\$3,000) - *Mobilizing the Carbon Market to Fight Poverty in Darfur and Throughout the Developing World, submitted by Kayje Booker, Reynaldo Guerra, Lisa Thompson:* Extreme violence has resulted forced relocation of over 2 million displaced people in the Darfur region of Sudan and has exacerbated issues of poverty, food security, and health that have plagued the region for some time. The application of low-cost, appropriate technologies presents an opportunity to significantly improve the quality of life in the Internally Displaced Person (IDP) camps that have proliferated in the Darfur region. Specifically, the Berkeley-Darfur cookstove, developed especially for the Darfur IDP camps, has the potential to enhance the economic situation of the IDPs, reduce exposure to gender-based violence outside the IDP camps, decrease levels of indoor air pollution, and slow the unsustainable harvesting of wood for fuel.

Our project has three main goals: 1) to obtain funding for dissemination of 300,000 Berkeley-Darfur cookstoves, approximately \$9 million total to cover all program costs; 2) to develop a comprehensive guide for other stove and development projects at Berkeley and nationwide to assist them in navigating the world of carbon trading to obtain project funding; 3) to introduce California policy makers to the idea of using carbon offsets in the nascent California carbon market to fund socially beneficial projects in the third world. This project will help to further establish UC Berkeley as a leader in developing innovative strategies to tackle poverty in the third world and will create additional opportunities for other Berkeley students to generate sustainable funding for their development projects in the third world.

4th place (\$2000) - *Returning to Microfinance's Mission: Improving the Lives of the Poorest; The Need to Evaluate Health among Haiti's Poorest, submitted by Jade Benjamin-Chung, Rita Hamad, Richard Lowe, and Jonathan Snowden:* This project, in collaboration with Fonsasyon Kole Zepol (Fonkoze), a microfinance organization that serves the rural poor of Haiti, will evaluate the health changes of the extreme poor participating in a program called Chemen Lavi Miyò (CLM), which will provide the extreme poor with an income-generating asset, such as a few chickens, a goat or a small business, as well as provide social services such as social awareness education and access to free health care. After graduating from CLM, participants will be prepared to join a standard microfinance program. In addition to evaluating the fiscal impacts of such programs on clients, it is important to evaluate the health effects because clients' basic needs must be met in order to fully take advantage of microfinance services. This health evaluation project establishes a legacy of collaboration between U.C. Berkeley students and Fonkoze to reduce the burden of poverty in rural Haiti.

4th place (\$2000) - *Iganga Economic Empowerment: A Holistic Approach to Rural Development in Eastern Uganda, submitted by Winnie Hung, Brent Anderson, and Niny Khor, with contributions from Boniface Kawiiso, Marketing Officer for Caritas-Uganda and Paulo Bateeze, Program Coordinator for Caritas-Uganda:* Our proposal introduces a pilot project in the Iganga District of Uganda which will bridge sustainable agricultural and animal husbandry skill development programs with microfinance services that will enable rural villagers to overcome the traditional barriers to earning an adequate income. Our implementing and host partner, Caritas-Uganda, which has been involved in the innovation

and planning of this proposal from the start of this process, has the organizational capacity and vision necessary to bring our proposal to fruition.

Green Cities

1st place (\$5000) - CalCap, submitted by Scott Zimmerman and Fahmida Ahmed: CalCAP is a collaboration of student, faculty, administration and staff for reducing greenhouse gas emissions at UC Berkeley. Sponsored by the Chancellor's Advisory Committee on Sustainability, and partnered with the Berkeley Institute of the Environment and the Energy and Resources Group, CalCAP has the following goals:

- Significantly reduce the carbon footprint of the UC Berkeley campus
- Demonstrate an institutional commitment to climate change mitigation
- Engage academic departments on campus and leverage academic research
- Foster local community development and action
- Inspire individual action

2nd place (\$3000) - Urban Eco Blocks, submitted by Erin O'Mahoney Cubbison: How can design at the urban block scale accomplish the integration of sustainable systems, considering environment, equality, and economy? The intent of the project is to make a significant contribution to sustainability in the built environment: Research + Design = Prototype Eco-Block. My objectives are to investigate the cycles of water, energy, and waste, and their impact on design. I will explore how they can be generators of form, structure, aesthetics, and human interaction. The concept of the "Eco-building" has existed for decades, and the "Eco-city" is currently a very popular topic. It seems that the scale of the "Eco-block" has rarely been explored but has great potential as a form of sustainable design implementation. In this project, I will develop the design of an eco-block prototype and present the economic case for its implementation.

3rd place (\$2000) - Green Cement, submitted by John Anderson: The cement industry is faced with the challenge of reducing the large amounts of carbon dioxide emitted during the production of ordinary Portland cement. Although improvements can be made to the existing process, these would not bring about significant reductions in carbon dioxide. Thus a more realistic solution strategy is to replace ordinary Portland cement with an alternative binder, which emits dramatically less carbon dioxide. Such an alternative would face harsh scrutiny in regards to its mechanical properties, costs, processing, and applications. These challenges, while significant, do not prevent such a material from achieving wide-spread use in the construction industry. The goal of my research is to further examine the mechanical, chemical, and engineering properties of an alternative binder. California would be the initial target audience for a low carbon dioxide cement due to the unique position of the state in addressing global climate change.

Improving Student Life – Undergraduate

1st place (\$5000) - Instilling Service in the Freshman Experience: The Civic Engagement Living-Learning (CELL) Program, submitted by Brittany Murlas: The Civic Engagement Living Learning (CELL) program is innovative not only in its method, but also in its mission—to instill a value of service in the UC Berkeley community. Although the residence halls represent one of the most influential environments for student development, this resource remains untapped at UC Berkeley. The CELL program uses the opportunity of the Residence Halls to encourage students to explore their role in shaping the communities that they are part of—their Residence Halls, the UC Berkeley Campus, the City of Berkeley, and even our global community. Unlike any other program at Cal, the CELL program not only involves living-learning environments, but will also impact students and communities through service-learning. Using new forms of pedagogy and class structure, the CELL program brings academics *into* the community, and communities *into* academics, reminding UC Berkeley of its purpose of higher education: “to serve as a civically engaged, and active leader in preserving, promoting, and educating for a democratic society.”

2nd place (\$3000) - The Interfaith Action Initiative, submitted by Carson Baucher, Jonathan Blake, Daniel Saver, Hosna Sheikholeslami:

Our proposal, the Interfaith Action Initiative (IAI), seeks to increase the opportunities for interaction between students of different faiths at UC Berkeley. We believe that open dialogue and collaboration are increasingly important in order to build a strong campus community around issues central to students of all faiths. We also believe that collaborative projects could plant seeds that have a profound impact on how students perceive religious traditions—their own and others—as they leave campus.

3rd place (\$2000) - OutLet LGBTQ Online Peer Advising, submitted by Aaron Cook:

OutLet lesbian, gay, bisexual, transgender, and questioning (LGBTQ) online Peer Advising was started as a result of one student’s feelings of isolation and frustration in coming to terms with his sexuality. Coming out can be a very difficult process. Like many other changes, experiences, and events that we face in our day to day lives, coming out affects many people in many different ways. OutLet is an online space created by students for students. We recognize that coming out is not easy for everyone, and in fact is not easy for most. We are here to provide a space in which students feel comfortable discussing those issues that they would never discuss out loud or face-to-face. The goal of OutLet is give students a space for confidential, anonymous discussion in order to bridge the current void between stark isolation and face-to-face counseling.

Improving Student Life – Graduate

1st place (\$5000) - The Berkeley Project, submitted by Angela Ngo: The purpose of the Berkeley Project is to build a legacy of service and a strong, sustainable partnership between the students of the University of California, Berkeley and the city and residents of Berkeley. To this end, the Berkeley Project’s foremost plan is to hold a yearly event, called Berkeley Project Day, where thousands of Cal students unite on one day to fulfill the pressing needs of

the community through a variety of service projects, all of which are within the City of Berkeley. Fully student operated and supported, the Berkeley Project not only provides crucial assistance to the public, but also aims to create a lasting culture of service among its participants. This year, the Berkeley Project will be held on October 27, 2007.

2nd place (\$3000) - *Students for a Safer Southside, by Amber Woodburn:* Preliminary data for the Pacific Institute for Research and Evaluation Fall 2006 Safer California Universities Study reports that the greatest number of self-reported alcohol problems occur in Greek Houses followed by off-campus apartments or houses, a majority of which are located in the south campus area. Through funding by the Bears Breaking Boundaries contest, the student group, Students for a Safer Southside (SFSS) will utilize the Substance Abuse and Mental Health Services Association model program, *Community Trials Intervention for High Risk Drinking*, to continue our two year-plan of reducing high-risk drinking behaviors by at least 5% among students who live, work, or otherwise frequent the south campus area of the University of California, Berkeley.

Information Technology for Society

1st place (\$8500) - *Telemicroscopy for Disease Diagnosis, submitted by UC Berkeley students David Breslauer, Robi Maamari, Alison Lynch, Gene Cho and Katrina Lin:* This proposal aims to create a simple, convenient, and cost-effective optical microscopy system for developing countries by converting camera-enabled cell phones into microscopes capable of routine disease diagnosis.

1st place (\$8500) - *Coupling Output-based Aid and Mobile Technologies, submitted by Ben Bellows, Mahad Ibrahim, Sonesh Surana and Melissa Ho:* This team will look at the feasibility of using smartphones to improve the efficiency and effectiveness of health service delivery in Uganda with implications across many developing regions with poor healthcare and limited information technology infrastructure.

Special Prize for Best Use of IT for Rural America (\$5000) - Summer of Service Technology Institute, submitted by UC Santa Cruz students Christina Hamill and Julie Caso: Their proposal will help fund a five-day tech camp for youth leaders from the Digitally Abled Producers Project (D@PP) of the Central San Joaquin Valley. The tech camp is organized by collaborative efforts of UCSC undergraduate students, the Global Information Internship Program (GIIP) and the Center for Multicultural Cooperation (CMC). D@PPers will receive an introduction into college life and hands on instruction in technical skills for social change.

Second prize (\$3000) - Information Technology Platform to Help Motorized Wheelchair Users Achieve Universal Access, submitted by Jesse Leaman: The project will test the feasibility of creating an Information Technology (IT) platform which can be mounted onto any motorized wheelchair with the goal of increasing the user's safety, productivity, and overall quality of life.

Third prize (\$2000) - iCare: Direct Person-to-Person Charity for Natural Disaster Relief,

submitted by Anand Kulkarni, Urvashi Gupta, and Ephrat Bitton: a new IT system that directly pairs individual donors and recipients of aid via the principles of peer-to-peer delivery and swarm distribution.

Third prize (\$2000) - Developing Interactive Lifecycle Assessment Tools for Consumer-level Goods and Services, submitted by Scott Zimmerman and Chris Jones: aims to place powerful, user-friendly and informative lifecycle assessment tools directly in the hands of consumers, retailers, producers, and city governments to allow for more informed consumer choices and how they impact the environment via CO2 production.

Open Ideas

1st place (\$5,000) - The Social Entrepreneurship Initiative at Berkeley by Matt Evans, Jason Kibbey, Michael Pearce: UC Berkeley is an ideal center for social innovation. It is consistently rated among the top institutions in the world for the quality and breadth of its research enterprise. Students and faculty from a wide variety of academic disciplines are currently working on solutions to some of the world's most pressing problems and creating solutions ranging from biofuels to malaria treatments. UC Berkeley also has an environment conducive to innovation and progressive ideas and a track record of taking new ideas from concept to “market.” Social entrepreneurs such as Paul Rice, the founder of the fair trade certifying organization TransFair launched their ideas from Berkeley, as have technological entrepreneurs like Steve Wozniak.

For new solutions to move from lab to practice, they will require strategic planning, operational, and management expertise, as well as a means to identify and engage with relevant partners from other disciplines and from the nonprofit and for-profit sectors. The Social Entrepreneurship Initiative at Berkeley (SEIB) would serve as a launch pad for students and ideas focused on social problems.

2nd place (\$3,000) - Partner Notification for HIV Prevention in the Northwest Province of Cameroon by Suzanne Welty, Professor Pius Tih, Thomas Welty:

Cameroon has an HIV seroprevalence among adults of 5.5% and meets the WHO’s definition of a generalized epidemic. Women have been disproportionately affected by HIV and are also infected at a younger age than men. It is important for the HIV epidemic in Cameroon to understand why so many young women are being infected, if in fact “sugar daddies” play a role, and if there are high risk male transmitters who infect more than one girl. Until recently, contact tracing (partner notification) was not thought to apply to HIV in the developing world. Partner notification has been deemed not possible as a means for controlling the HIV epidemic in the developing world because of issues of confidentiality and cost. This proposal aims to use an innovative approach for partner notification for HIV in Africa to determine:

1. the risk factors for HIV positive adolescents from the NW province of Cameroon who are identified through youth testing programs;
2. the acceptability and feasibility of partner notification among HIV positive youth in Cameroon

3. how many undiagnosed HIV cases are identified through partner notification.

3rd place (\$2000) - Biofueled Future for Central America – Developing a Business Model for Panama by Jit Bhattacharya: Central America represents one of the most significant opportunities for biofuels to aid in the economic development of a region while also helping reduce global dependence on fossil fuels. Central America's climate allows the region to produce significant volumes of the biofuel feedstocks sugarcane and palm oil. A study by CGEE quantified that nearly 5% of gasoline demand could be met by ethanol in Central America produced only from molasses without sugar production at all. These biofuels represent more than just the basis for transportation fuels. Using the by-products from biofuel production as inputs into biodigesters, Central America can create closed-loop biofuel cycles that contribute to growing energy needs in both the transportation sector and the electricity sector. By building on the Brazilian model and addressing the problems with Brazilian biofuel production from the beginning, a biofuel business model for Central America can be developed that is socially beneficial to smaller rural farms, environmentally sustainable in terms of feedstock production, and environmentally beneficial in terms of reducing greenhouse gas emissions. With the larger goal in mind, the purpose of this project is to design a new model for bioenergy development with an initial focus on Panama.

3rd place (\$2000) - Racism and Inequity in Structures of Education (RISE) to the Forefront, an Undergraduate Organization and Project by Clara Bosak-Schroeder, Ziza Delgado, Amy Elmgren, Rene Flores, Mary Candace Full, Dan'l Martinez, Brittany Murlas, Marissa Sitka, and Vivian Win: RISE to the Forefront proposes to create a conference on the UC Berkeley campus in March of 2008 entitled, "Racism and Inequity In Structures of Education (RISE): Collaborative Solutions for a Challenging Time." We envision this conference occurring as the culmination of one full year of 1) building collaborations and, 2) developing as both scholars and activists within the UC Berkeley undergraduate community. We seek to mobilize UC Berkeley students to join RISE to the Forefront in inviting educational scholars from across the nation as well as teachers and students from all levels of education to create and sustain valuable partnerships and multidisciplinary collaborations at this conference. Attendees will present and participate in this innovative gathering for the purpose of communicating their research and organizing for social justice and equity. Conference committee papers will be written after the conference and will be compiled by RISE to the Forefront to publish for national distribution.

3rd place (\$2000) - The Student Parent Outreach for Higher Education Program (SPOHEP), submitted by Christyna Maria Serrano: The Student Parent Outreach for Higher Education Program (SPOHEP) will target students who are parents, attending Laney, and Merritt College, and who are enrolled in the Extended Opportunity Program and Services (EOPS) program. EOPS provides financial and academic support to community college students whose educational and socioeconomic backgrounds may prevent them from successfully attending college. The SPOHEP will supplement EOPS by providing outreach, education, and mentorship services in order to increase the number of student parent transfers into a four-year college. Thus, the goals of SPOHEP are to give low-income student parents the opportunity to achieve self-sufficiency, social, and economic mobility for themselves and their children through utilizing the vehicle of higher education. In order to successfully fulfill this

goal, SPOHEP will coordinate between the Transfer, Re-entry and Student Parent Center at U.C. Berkeley (TRSP), and the EOPS programs at Laney, and Merritt College, to increase awareness of the value of higher education, the steps required to attain it, and increase the transfer eligibility, and number of student parent applicants to higher education institutions. SPOHEP will prepare its participants for standards of transfer to UC Berkeley, with the idea that if they can achieve entry into Berkeley, they can go to any other university they want.

3rd place (\$2000) - *The Homeless Mental Health Initiative by Karandeep Samran Sarah Adler-McDonald, Jodi Ram, Karandeep Samran, Stephanie Wong, Tanvir Kapoor:* The mission of the Homeless Mental Health Initiative is to provide free, quality counseling, psychiatric, and mental health promotion services to the homeless and low-income population of Alameda County. Through the collaboration of mental health professionals and students from various disciplines, we will deliver holistic care that empowers and educates clients rather than just mitigating their symptoms.

Science, Technology and Engineering Policy

1st place (\$2000) - *Incentivizing Air Capture Through Emissions Offsets and Greenhouse Gas Property, submitted by Derek Lemoine:* Policy proposals for controlling global climate change have focused on greenhouse gas (GHG) emissions reductions, but because climate change is driven by accumulated atmospheric stocks of GHGs, policies should include incentives to reduce these stocks. One feasible stock-reducing technology is air capture of carbon dioxide, which can take the GHG from the atmosphere and permanently sequester it underground. Development and deployment of this technology will require long-term incentives that are not found in current climate change policies. A first step towards providing such incentives is to include air capture as an offset for emissions under traditional cap-and-trade programs. A more comprehensive proposal is to shift the focus of climate change policy from emissions to atmospheric concentrations by developing a GHG property and tax regime. We should include long-term incentives for air capture in federal climate change policy, and we should introduce the idea of a GHG property regime into the climate policy discourse.

2nd place (\$1500) - *The Berkeley City Ordinance on Nanotechnology, submitted by Javiera Barandiaran:* Nanotechnology will revolutionize material science, leading to a proliferation of new materials some of which may be toxic to human health and the environment in different ways than has been the case with known chemical substances. For the purposes of this memo, a new material is defined as a material with a chemical structure or molecular identity different from any observed in an existing chemical. This memo proposes a draft list of specific recommendations to guide future nanotechnology ordinances. Specifically, these recommendations focus on the use of a closed, questionnaire type information collection tool and proposes mechanisms to incentivate compliance. A pre-codified format would facilitate the classification of nanomaterials into a reduced number of categories. The resulting reduction in complexity would allow for the coordination of classifications with toxicological control bands, ease the sharing of information across different institutions for the creation of a national database, and add transparency which allows for increasing adaptability.

3rd place (\$1,000) - Policy Initiatives for Safe Realization of Synthetic Biology's Power, submitted by Eric Steen and Jeffrey Dietrich: Synthetic biology promises to be one of the major innovating fields of this century and is poised to make impacts in some of the most significant problem areas. It has the potential to solve some of the world's most important problems, ranging from decreasing the cost of expensive therapeutics to weaning our dependence on foreign sources of energy. However with its great potential for positive societal impacts, also comes a great potential for misuse; of greatest concern is the potential for bio-terrorism. Additionally, the long-term sustainability of synthetic biology will depend upon correct structuring of intellectual property policy in the field.

3rd place (\$1000) - Bringing Neutrality to Network Neutrality, submitted by Kai Zhu: Network neutrality (NN) is becoming a fiercely debated issue within Internet-related industries, academia, the public, and Congress. Internet service providers such as AT&T and Verizon want to prioritize Internet traffic and profit on the prioritization. Internet content providers such as Google, Yahoo, and Microsoft want to ban such prioritization via NN legislation. This paper analyzes the debate from both a technical perspective and an economic perspective. In particular, the paper argues that (1) the Internet has never been neutral and has never been designed to be neutral; (2) Internet traffic prioritization can both coexist with and encourage Internet innovation; and (3) some minimal regulation is needed to prevent market power abuses and usage discrimination in the Internet service market. The paper concludes that the fundamental policy challenge in the NN debate is to strike a balance between incentives that are essential for Internet innovation, and monopolies that are necessary for incentives but harmful for innovation. Finally, the paper proposes a technically feasible solution to the NN debate that can serve as a policy guide for the legislature.

Synthetic Biology

1st place (\$1500) - Escherichia coli Based Red Blood Cell Substitutes: Cheap, High Volume, and Totally Awesome, submitted by Austin Day: The global demand and importance for cheap, available, and disease free blood substitutes is undisputed. There are currently no red blood cell substitutes approved for clinical use in the US or the UK and whole blood is almost always in short supply. Underdeveloped countries that need blood the most simply don't have the infrastructure to support donation and storage, in addition to a sizeable fraction of the population are disease carriers. By presenting this problem to synthetic biologists, one must expect the initial "knee jerk" response of throwing bacteria at it. In this case, however, using an E. coli chassis as an artificial red blood cell (RBC) membrane that encapsulates E. coli produced functional adult hemoglobin may not be such a bad idea. This usage of the entire bacterium as the artificial RBC allows for cheap, high volume, disease free production of a potential RBC substitute.

2nd place (\$500) - Environmentally Self-Regulating Bacterial Network (ESRBN), submitted by David Tulga: Synthetically engineered populations of bacteria currently show promise towards solving challenging problems in the fields of medicine, agriculture, and energy. However, bacterial population proliferation is currently uncontrolled and inefficient, and therefore lacks widespread applicability. By creating the ESRBN, the resulting bacterial populations not only control their growth based on density and extracellular cues, but also

modify their external environment to match a set of desired parameters. This self-regulating mechanism provides a controlled framework for symbiotic and non-invasive applications, while adding to the efficiency and applicability of existing synthetic bacterial technology.