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ANNOUNCEMENT
Academic Venture Fund Awards

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The Cornell Center for a Sustainable Future announces the spring 2010 awards from the **Academic Venture Fund**. Initiated in 2008, this fund is designed to stimulate original, cross-disciplinary research at Cornell in sustainability science, emphasizing work having the potential to involve external partners such as industry, government, foundations, and NGOs. The 25 proposals submitted in response to the latest AVF solicitation represent a vibrant, innovative, interdisciplinary movement at Cornell.

All of the proposals surpassed the goals of this solicitation by proposing basic or applied research that includes investigators from more than one college or school and/or encompasses two or more of the Center's sustainability themes of energy, environment, and economic development. The focused guidance provided by CCSF directors clearly bolstered this exceptional outcome.

Researchers from the Engineering and Agriculture and Life Sciences colleges are well represented, often in multidisciplinary teams. This round of proposals also included investigators from the colleges of Arts and Sciences; Art, Architecture, and Planning; and Veterinary Medicine; the Faculty of Computing and Information Science; the Johnson Graduate School of Management; Cornell Law School; and the School of Hotel Administration. Over 90 percent of the proposals involved investigators from more than one college or school, and over 40 percent included faculty from three or more colleges or schools.

To evaluate the submissions, CCSF convened three review panels, each composed of distinguished faculty from across the university. Each proposal received at least three written reviews, in addition to a panel review. The ranked funding recommendations of the three panels were reviewed by the CCSF leadership team and final award decisions were based on the reviews and available funding. Eight proposals were selected for total funding of $598,027 in this round of the AVF. Many more promising proposals were submitted than CCSF could fund; there are tentative plans for another round of AVF awards next year.

Created in the fall of 2007 by the Office of the Provost, the Cornell Center for a Sustainable Future (CCSF) serves the sustainability research community at Cornell. The Center addresses the breadth of sustainability research with three interconnected themes: **energy, environment, and economic development**.

To learn more about the CCSF, please visit our website at http://www.ccsf.cornell.edu/. You will find information about the seventeen AVF awards made in 2008 and 2009 at http://www.ccsf.cornell.edu/avf/.

Development of Biochar-Based Fibers for Personal Protective Equipment

Protective clothing, gloves, and footwear are essential for emergency workers and many others routinely exposed to toxic chemicals. Current technologies for chemical protective liners are based on activated carbon or rubber composites filled with carbon black. Replacing these substances with biochar—a stable charcoal product—may provide a greener, more sustainable route to the next generation of chemical protective clothing. This project will develop nonwoven biochar fibers that can be used to produce personal protective equipment to reduce wearers' exposure to toxic compounds. The researchers will test the capacity of 20 different biochars to absorb organic pollutants, measure the biochars' suitability for incorporation into nonwoven fibers, and identify several promising biochar fiber combinations for further study and potential mass production. In addition to their application in chemical protective gear, biochar-based fabrics may later serve as geotextiles for containing toxic spills and as sampling devices for assessing contamination on solid surfaces. Wider use of biochar will reduce our reliance on petroleum products and fight climate change.

Investigators: Anthony Hay (BIOMI), Juan Hinestroza (FSAD)
Funding: $99,500 *Duration:* 12 months
External Partners: iFyber, LLC

Modeling, Systems Engineering, and Risk Analysis for Carbon Sequestration

Geologic carbon sequestration (GCS)—injecting pressurized carbon dioxide deep underground, beneath impermeable caprock—promises to be a powerful tool in the mitigation of global climate change. It may take decades to develop economically viable renewable energy technologies that will reduce production of fossil fuels significantly. During this transition period, excess carbon must be stored without further polluting the atmosphere. Although natural accumulation of carbon dioxide underground and the oil industry's successful engineered disposal of carbon dioxide suggest that GCS is safe, public concern continues about injected carbon dioxide leaking through rock fractures or abandoned wells to cause air or groundwater contamination. This project will employ a systems engineering approach to develop a model for analyzing, quantifying, and monitoring the risk of GCS. This methodology will inform decisions about whether to initiate a carbon sequestration project at a specific site and how to maintain it safely over a long period of time. Making GCS more cost-effective and reliable through better monitoring and reduced risk will reduce the amount of carbon dioxide in the atmosphere, promoting a sustainable climate and cleaner environment.

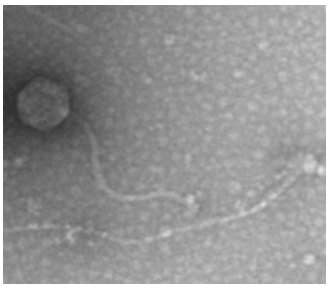
Investigators: Christine Shoemaker (CEE), Philip Liu (CEE), Teresa Jordan (EAS)
Funding: $100,000 *Duration:* 24 months
External Partners: Lawrence Berkeley National Lab (Doughty and Finsterle)

Monitoring Air and Water Quality in Marcellus Shale Drilling Sites

Natural gas drilling in the Marcellus Shale promises a new source of energy, but the drilling process raises environmental concerns about potential effects on air and water quality. Drilling is under way in Pennsylvania and West Virginia and is likely to begin soon in New York, yet systematic monitoring procedures are not in place to protect natural resources and public health. A monitoring program is needed to provide information on the frequency and severity of any environmental damage caused by drilling operation accidents or poor practices and establish accountability for damage caused by drilling. Systematic monitoring will also help assess public health impacts associated with the drilling process and yield critical information about effects on adjacent industries, such as agriculture and tourism. This research project will develop procedures and protocols as the groundwork for programs to monitor air and water quality in the counties where Marcellus Shale drilling is occurring. The project promises to raise public awareness of the full range of costs associated with natural gas extraction and lead to more informed policy decisions.

Investigators: Susan Christopherson (CRP), Kieran Donaghy (CRP), Albert George (MAE), Susan Riha (EAS)
Funding: $49,500 *Duration:* 12 months
External Partners: Park Foundation and Heinz Foundation

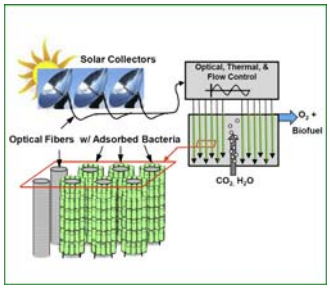
Replacing Antibiotics in the Food Animal Industry with Bacteriophages



Several antibiotics have gradually become less effective as new kinds of multidrug-resistant bacteria "superbugs" have emerged; widespread reliance on antimicrobials in food animal production has increased the prevalence of drug-resistant bacteria. Replacing some antibiotic use in the food animal industry with naturally occurring bacteriophages—viruses that infect bacteria—would decrease environmental contamination with antibiotics. Bacteriophages are the perfect antimicrobial agents: highly specific to a few bacterial species or even strains, they are nontoxic to mammals. Designing an economically feasible phage cocktail requires finding the smallest group of phages that effectively kills the target, and bacteriophages' specificity complicates the task. This innovative project, combining biology and statistical analysis, will isolate and evaluate new bacteriophages and develop mathematical models to optimize the phage cocktail. The study will culminate in large-scale production of a phage cocktail and a clinical trial on 900 dairy cows, leading to an economic model for evaluating the cost-effectiveness of phage therapy for commercial dairy farms. This research promises to harness the antibacterial power of bacteriophages, eventually replacing antibiotics for the treatment of common bovine diseases—and may eventually lead to phage therapies for human diseases.

Investigators: Rodrigo Carvalho Bicalho (VTPMD), Peter Frazier (ORIE), Thorsten Joachims (CS)
Funding: $100,078 *Duration:* 18 months
External Partners: Cayuga County commercial dairy farms: Sunnyside Dairy Farm, Ridge Crest Dairy Farms, Aurora Ridge Dairy Farm, MacGarr Dairy Farm, and others

Thousandfold Improvement in Solar Photobioreactors Using Advanced Photonics



Replacing fossil fuels with biofuels produced from sustainable sources promises to reduce carbon dioxide emissions and increase energy security, but current crop-based biofuel production is inefficient and competes for land use with traditional agriculture. The natural photosynthetic process—using solar energy to capture carbon dioxide and produce biofuel and oxygen—provides the ultimate model of sustainable energy generation. An emerging strategy for harnessing photosynthesis is the direct conversion of carbon dioxide to biofuel using photosynthetic bacteria, such as cyanobacteria (blue-green algae), but the technology is limited by current reactor designs. This project will develop a proof-of-concept photobioreactor that makes efficient use of the sun and photosynthetic bacteria to convert carbon dioxide into biofuel, resulting in an improvement of at least three orders of magnitude over current reactors. This new photobioreactor will make solar biofuel generation feasible year-round, even in climates like New York State—promising energy security for the United States and environmental sustainability on a global scale.

Investigators: David Erickson (MAE), David Sinton (MAE), Largus Angenent (BEE)
Funding: $100,000 *Duration:* 24 months
External Partners: University of Victoria, Canada and Phycal LLC

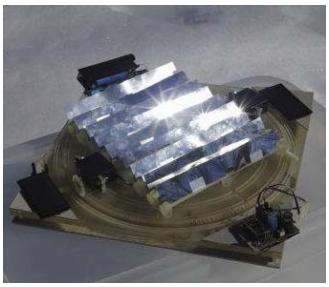
Water Governance in the Mediterranean Basin and Middle East

The Mediterranean and Middle East are among the regions most severely affected by the global water crisis. As water becomes scarce relative to demand, competition for shared rivers and other water resources will grow. Without institutional mechanisms to respond to these transboundary problems, competition has the potential to fuel disruptive conflicts—but may also become a catalyst for cooperation. This two-year project will explore the role of the university and its scientific capabilities in the governance of sustainable water development. The study will assess the adequacy of water legislation in the Mediterranean Sea and its basin, research the reasons behind poor compliance, and develop effective monitoring systems and local enforcers' capacity to promote compliance. Cornell researchers will partner with United Nations Development Programme's newly established Water Governance Program for Arab States and University of Newcastle's Rural Economy and Land Use Program, hosting a workshop on water governance with representatives of partnering organizations, to be held at Cornell Law School in the fall of 2010. Knowledge gained from the Mediterranean will be of immediate use in other water-short areas of the world, including the United States.

Investigators: Gail Holst-Warhaft (A&S), Tammo Steenhuis (BEE)
Funding: $93,899 *Duration:* 24 months
External Partners: Water Governance Program for Arab States (WGP-AS), University of Newcastle's Rural Economy and Land Use Program (RELU)

WORKSHOPS

Self-Powered Wireless Solar Tiles for a Renewable Energy Future



People are more likely to embrace sustainable living when they can incorporate rewarding actions, such as recycling, into their daily lives. This project will develop and analyze the likely impact of new solar tiles that allow the owner to allocate a proportion of tiles to different functions, including harvesting solar energy or wind, redirecting light for natural lighting, sensing temperature to regulate home energy use, and even listening to radio frequencies in outer space. The wireless tiles—recently invented at Cornell—are self-powered by sunlight and wind and can be controlled by home computer or iPhone. The research group will investigate the utility of the tiles, build a prototype system, and host a workshop in the fall of 2010 to promote the new tiles and report on research challenges. Despite the tiles' advanced capacities, initial prototyping suggests that the cost may be lower than covering rooftops with passive solar cells—bringing personalized, sustainable energy within the reach of individual homeowners.

Investigators: Amit Lal (ECE), Anil Netravali (FSAD), Kevin Pratt (ARCH), Hod Lipson (MAE)
Funding: $15,000 *Duration:* 12 months
External Partners: Possible future partners include DOE, NYSERDA, Syracuse University, and Columbia University

University Collaboration on Wind Energy

The U.S. Department of Energy (DOE) has set the ambitious goal of generating 20 percent of the nation's electrical power from the wind by 2030. Sustained growth of the wind-power industry will require the steady improvement of wind turbine technology, modifications to power distribution systems, and changes in energy price structures and markets. This project aims to build a community of researchers—a team of universities, national laboratories, and industrial partners—that will collectively present a proposal to the DOE to launch a long-term research program in wind energy. The investigators will host a workshop to organize key university partners involved in wind energy, including the Massachusetts Institute of Technology, University of Michigan, University of Notre Dame, Johns Hopkins University, and Texas Tech University, which will join Cornell in promoting a new wind-power research program. A DOE-sponsored, cooperative research effort has the potential to overcome existing technological and environmental barriers to wind energy, allowing the nation to rise to the goal of "20 percent by 2030."

Investigators: Lance Collins (MAE), Christopher Clark (LABO), Alan Zehnder (MAE), Philip Liu (CEE)
Funding: $40,000 *Duration:* 6 months
External Partners: MIT (Sclavounos), U. Michigan (Waas), Notre Dame (Corke), Johns Hopkins (Meneveau), Texas Tech. (Chapman)

Further CCSF Research Support at Cornell

In addition to the Academic Venture Fund awards, CCSF funds, cosponsors, and participates in faculty recruitment and a variety of sustainability research activities and collaborations, projects, proposals, workshops, conferences, and seminars. CCSF coordination and support helped Cornell sustainability faculty teams secure more than $45 million in funding from external sources. Requests for nearly $40 million more are still pending. This funding is awarded directly to the principal investigator's department, school, college, center, or unit. Instead of seeking to manage external resources, CCSF helps teams grow by connecting them to individual philanthropists and external partners in government, industry, foundations, and NGOs.