Earth System Initiative

The Earth System Initiative (ESI) was formed in 2002 to encourage and coordinate multidisciplinary research and education efforts in the earth sciences and engineering at MIT and to develop strategies to communicate this new knowledge to the citizens, policy makers, and corporate decision makers whose actions determine how Earth's resources are managed. The faculty involved in the Initiative are drawn primarily from the departments of Civil and Environmental Engineering (CEE) and Earth, Atmospheric, and Planetary Sciences (EAPS), but ESI also has representation from the Chemistry, Electrical Engineering and Computer Science, Biology, Biological Engineering, and even Anthropology departments.

Research Support

ESI currently has a research portfolio that includes approximately $42 million in funded projects (an average of approximately $6 million per year) and over $24 million in pending proposals. These projects include collaborations among faculty in the Schools of Engineering and Science and bridge the gaps between fields that include biology, geology, chemistry, atmospheric sciences, and electrical engineering and computer science. Some are detailed in the sections below, as are additional sources of support.

Administration

The director of ESI is Professor Penny Chisholm (CEE and Biology) and the executive director is Dr. Matthew Gardner.

ESI currently has eight distinguished alumni and colleagues serving on its Directors Council, chaired by MIT alumnus Arunas Chesonis, '84. This group will meet again soon in conjunction with the upcoming ESI symposium in October 2007. The role of the Directors Council is evolving and will likely be revised in composition and purpose in the coming year.

Highlights and Activities

The Moore Foundation Relationship

ESI is continuing efforts to broaden the scope of its research portfolio. Our biggest success in this regard is the growing relationship with the Moore Foundation. ESI's conversations with the Moore Foundation early on contributed to the foundation setting up its Marine Microbiology Initiative. As Moore investigators, Professor Chisholm and Professor Ed DeLong are beneficiaries of this initiative, receiving $5 million each over five years for their research in marine microbial genomics. These awards are up for renewal in the spring of 2008 and we anticipate that an additional three to five years of support at the same level will be forthcoming. Building on this momentum, the Moore Foundation has also supported the research of Professor Martin Polz, who will receive just under $1 million over three years for his research on marine Vibrio bacteria. Even more exciting is the recent grant administered through ESI for $4 million dollars over three years to support the Darwin Project, a flagship project for ESI. The project is directed by Dr. Mick Follows in EAPS, and brings together colleagues from

CEE, EAPS, and the Computational and Systems Biology Initiative (CSBi) to build models of microbial ecosystems in the global oceans from the genome scale to the biome scale. As the only player in this research area at the moment, the Darwin Project has a tremendous opportunity to shape the field of global systems biology. In addition to funding Professor Follows' research, the Darwin grant includes funds to enhance ESI's computational infrastructure and to create a state of the art Visualization Wall for genomics and global simulations that will be installed as part of the Computer Science and Artificial Intelligence Laboratory in the Stata Center. It will also fund a Lambda Rail high-speed optical internet link so ESI can be directly linked to the growing environmental genomics database at the University of California, San Diego and participate in the activities of CAMERA, a Moore-funded project at the California Institute for Telecommunications and Information Technology that will be a central repository for genomic data from marine microorganisms. Finally, the grant includes funds to support an ESI postdoctoral fellow who will serve as the link between CSBi and ESI for three years. We are heartened by the enthusiasm of Bruce Tidor (CSBi) for this project, and his eagerness to work together with us.

In summary, ESI has played a direct role in generating almost $20 million in funding from the Moore Foundation.

Education and Outreach

ESI has developed a number of valuable partnerships with local and regional organizations such as the Museum of Science, the New England Aquarium, the Ecotarium, the Edgerton Center at MIT, and TERC. These partners work with ESI and its research teams to develop effective education and outreach programs based on ongoing ESI research. Researchers can participate in these programs for a small incremental cost to their research grants. Participation helps them meet funding agencies requirements for broader impacts and may increase the likelihood of a successful grant application.

Center for Microbial Oceanography: Research and Education

ESI researchers including Penny Chisholm, Ed Delong, and Ed Boyle play a prominent role in the Center for Microbial Oceanography: Research and Education (C-MORE). This National Science Foundation Science and Technology Center, funded by $20 million over five years, is based at the University of Hawaii with partners at Oregon State University, the Monterey Bay Aquarium Research Institute, Scripps, and other major research institutions. In addition to its research activities, the ESI team will also play a central role in the outreach and education programs of C-MORE.

Ignition Grant Program

Considerable effort has been expended to inform the broader MIT community as well as potential corporate and foundation donors about ESI activities. In addition to its website, ESI has developed and disseminated a variety of materials that describe its research and education activities. The ESI Ignition Grant program, which has been championed by the chair of our Director's Council, has funded 10 $50,000 ignition grants in the past year. These funds, which come from individual donors, are intended to be used to support new areas of research that may not be ready for full support from traditional sources.

Already one ignition grant has been leveraged into a successful proposal for more than $600,000 in funding from a federal agency. Even more importantly, these ignition grants have been instrumental in helping ESI continue to build a community of affiliated faculty and research staff.

Director's Council chair Chesonis has also sponsored two faculty appreciation dinners: one at the American Academy of Arts and Sciences in 2006, and another in 2007 at the Isabella Stewart Gardner Museum. These events were rousing successes and were extremely well received by our faculty and students.

Linden Earth System Fellowship Program

ESI received a donation from the Lawrence and Dana Linden Family Foundation to create the Linden Earth System Fellowship program. These fellowships provide support for outstanding new graduate students who plan to pursue graduate studies in environmental sciences and engineering. The fifth class of fellows will arrive on campus in the fall of 2007.

Partnership with the Center for Global Change Science

In the fall of 2007 ESI will initiate a series of conversations with Professor Ron Prinn, director of the Center for Global Change Science (CGCS), regarding ways that we can leverage our collective research strengths and combine efforts in key strategic areas. ESI and CGCS-affiliated faculty will meet to discuss possible research topics to jointly pursue. This relationship is evolving and is a promising development in the environmental research portfolio at MIT.

Relationship with the MIT Energy Initiative

ESI is one of the affiliated units of the MIT Energy Initiative. We look forward to building a closer relationship with this important initiative in the future.

Symposium, Workshops, and Seminar Series

ESI sponsors regular seminar series, faculty retreats and workshops in order to continue to raise the profile of ESI within MIT and the broader academic community. On October 9, 2007, ESI will host a major symposium, "Earth System Revolutions—Key Turning Points in the History of our Planet," in collaboration with CGCS.

Future Directions

The growth trajectory of ESI's research portfolio has been quite good, and as we entrain more faculty into our community we expect it to grow continuously. ESI is actively seeking to broaden its research portfolio and encourage more multidisciplinary interactions along the lines of the Darwin Project. With the addition of Chairman Chisonis and Sarah Wood, executive director of the Chesonis Family Foundation, to our team, we are embarking on a significant fundraising campaign from private donors in the coming year.

We will continue to develop our partnership with the CGCS, and work on connectivity with the Energy Initiative.

Penny Chisholm
Director
Lee and Geraldine Martin Professor of Environmental Studies and Professor of Biology

More information about the Earth System Initiative can be found at http://esi.mit.edu/.