

Center for Environmental Health Sciences

The overriding goal of the Center for Environmental Health Sciences (CEHS) is the study of the biological effects of exposure to environmental agents so that we may better understand and predict how such exposures affect human health. Three fundamental components influence the physiological effects of environmental exposures: the nature of the exposure, the duration of that exposure, and how well the exposed organism is equipped to deal with the exposure—in other words, the organism’s genetic susceptibility. Environmental health research at MIT encompasses a wide range of disciplines, and CEHS continues to bring together faculty members who employ a diverse set of research tools to tackle problems relevant to environmental health sciences. During the last several years, CEHS has begun to include focused efforts on problems of particular relevance to the developing world, along with adding more human population-based studies.

Organization

Significant changes have been made recently in CEHS’s organization. The new organization is composed of an Administrative Core, the Community Outreach and Education Core (COEC), the Pilot Project and Career Development Programs, the Global Environmental Health Sciences Program, and four facilities cores, including a mandatory Integrative Health Science Facilities Core. Formal research cores are no longer required. This new organization fulfills the requirements of the National Institute of Environmental Health Sciences (NIEHS), our sponsoring agency.

The center’s membership currently consists of 36 faculty, scientists, and engineers, 33 from MIT and three from Harvard University (professors David Hunter, Jiali Han, and Ravi Thadhani). In addition, the center has one senior research scientist and three principal research scientists. The members of the Administrative Core, which is charged with the center’s overall operation, include professor Leona D. Samson, director; professor Peter C. Dedon, deputy director; Amanda Tat, administrative officer; Sophea Chan Diaz, financial coordinator; Julie Coiro, administrative assistant; and an information technology support specialist (TBA). COEC, which emphasizes education for K–12 teachers and students as well as adult and community outreach through the Museum of Science and the MIT Museum, is responsible for all CEHS outreach activities. COEC is administered by Dr. Kathleen Vandiver, director; associate professor Bevin Engelward, codirector; and Amy Fitzgerald, outreach coordinator.

Since the reorganization, research in CEHS is grouped into research themes that build on the strengths of the center’s membership. These themes are as follows:

- DNA damage, DNA repair, and mutagenesis
- microbes and disease susceptibility
- inflammation chemistry and biology
- bioengineering for toxicology
- exposure and response

CEHS continues a long tradition of providing its membership with state-of-the-art facilities cores that reflect, nurture, and support the center's research directions. CEHS researchers use these facilities cores heavily, with each core contributing to the research of the laboratories of at least 10 center members.

Under the direction of Drs. John "Pete" Wishnok and Koli Taghizadeh, the Bioanalytical Facilities Core provides center members with the latest tools, techniques, and expertise in the characterization and quantification of chemical substances and modifications of cellular molecules such as DNA and protein, as well as sophisticated proteomics and metabolomics research capabilities. This facilities core operates as a resource for the center and provides invaluable training for students and postdoctoral scholars to become proficient in mass spectrometry analysis.

Drs. Stuart Levine and Jennifer Calvo oversee the Genomics and Imaging Facilities Core, which provides center members with both a variety of sophisticated quantitative imaging technologies and an integrated facility for microarray fabrication and analysis, database storage, database management, data mining, and modeling. These tools are critical to the goal of moving CEHS research to higher levels of complexity in an attempt to understand the response of the organism to environmental influences at the systems level.

The Animal Models Facilities Core, directed by professor James Fox, provides center members with the latest technologies for the application of animal models to environmental health research, including the generation of genetically engineered mice, embryo rederivation of imported mice, colony management, and preparation and interpretation of murine tissues by histological and image analysis.

Under the direction of Professor Thadhani (assistant director of the MIT Clinical Research Center [CRC]) and Professors Dedon and Samson, the Integrative Health Science Facilities Core was recently developed to help center members translate their research activities into clinical and epidemiological realms. This effort involved formalizing a relationship between CEHS and CRC to develop a facilities core that will provide services to CEHS members involved in human health research, particularly studies with clinical human samples, clinical research, and statistics for human population-based studies and other activities.

Another major program in CEHS is the Global Environmental Health Sciences Program, led by professors Gerald Wogan (director) and John Essigmann (codirector). This program focuses on developing collaborative relationships between CEHS members and international researchers in environmental health, as well as on developing research training and education exchange programs for graduate students and postdoctoral scholars. Our global efforts thus far include Thailand, Vietnam, and Singapore.

Finally, CEHS will enhance its long-standing and successful support of pilot projects by initiating efforts to foster career development activities within the center. The Career Development Program, directed by professor Steven R. Tannenbaum, focuses on promoting the career aspirations of young scientists and engineers, as well as providing

new research opportunities for senior investigators who bring novel technologies and approaches to bear on CEHS research themes. The program's specific aims are as follows:

- attract and engage students, postdoctoral scientists, untenured faculty (junior investigators), and senior investigators in environmental health sciences and toxicology research and training
- provide mentorship and professional development for junior investigators
- promote research collaborations between junior and senior investigators and CEHS members
- facilitate cross-training of CEHS investigators in new techniques and technologies
- provide financial support for junior investigators to establish environmental health sciences research programs
- promote career development in environmental health sciences research for young scientists in the Global Environmental Health Sciences Program

The center will continue the Pilot Project Program, overseen by the center director and deputy director. This program has the following specific goals:

- provide initial support for junior investigators to establish new lines of research in environmental health sciences and toxicology
- allow exploration of innovative new directions representing a significant departure from ongoing funded research for established investigators in environmental health sciences and toxicology
- stimulate investigators from other areas of endeavor to apply their expertise to environmental health research
- promote the development of novel COEC activities arising directly from the research of center members

The center will establish a new Translational Pilot Project Program, which is separate from the regular Pilot Project Program. While we plan to encourage CEHS members and others to submit translational research projects for funding through the regular Pilot Project Program, we believe that it is important to also target translational research opportunities by providing funds to be used exclusively for that purpose.

Accomplishments in 2009–2010

CEHS has maintained a strong volume of research support, totaling over \$8.6 million in FY2010. These research programs are funded through a variety of sources, including the National Institutes of Health (National Cancer Institute and NIEHS), the Singapore-MIT Alliance for Research and Technology, various foundation and industrial support, and the National Science Foundation.

The Pilot Project Program allows for the conduct of novel research activities that use multidisciplinary approaches to the study of environmental health sciences. Due to the uncertainty of the center's renewed core funding, i.e., our NIEHS Core Center grant, we were not able to provide full support for the Pilot Project Program during the center's 2009–2010 grant cycle. However, we will issue a call for pilot project proposals in July 2010 and plan to fund only two projects rather than the usual five.

Through our center grant funding, we continue to support the COEC, which promotes community-level scientific literacy through a variety of hands-on programs for youth and teachers from sixth grade through high school. The COEC continues to run highly successful activities on campus: the two-day summer workshop on environmental health science research for teachers in July, and the classroom instruction sessions at the Edgerton Center for students on environmental health topics such as cell division and groundwater. An exhibit at the MIT Museum, *Learning Lab: The Cell* continues to reach many classroom groups as well as a large number of museum visitors.

Another goal of the COEC program is to create opportunities for MIT scholars to participate in public health and science education. We accomplish this by mentoring graduate students and postdoctoral scientists to participate in COEC activities. For example, numerous MIT graduate students contribute to the success of A Closer Look at Exposures, an event we sponsor annually at the Cambridge Science Festival with the Harvard School of Public Health.

Lastly, the new continuing COEC education program for health professionals, which started in 2009, continues to grow. The COEC now offers an annual two-day workshop, Cell Biology for Nurses and Health Professionals. As modern medical practice has become more molecularly based, nurses need to update their knowledge in basic cell biology and genetics. Nurses play a major role in public health such as translating health information for many individuals.

In an effort to reserve our center grant funding, we have postponed the center's seventh annual CEHS Poster Session, which is normally held in May, to February 2011. This event attracts over 100 participants, including CEHS members, students, postdoctoral scholars, scientists, and staff, as well as other MIT faculty members. The Myriam Marcelle Znaty Research Fund continues to sponsor first and second place cash prizes to poster winners in both the graduate student and postdoctoral scholar categories. The CEHS Poster Session has become an annual event that receives overwhelmingly positive feedback in terms of promoting scientific exchange and collaborations, as well as introducing CEHS to the broader MIT community.

Plans for 2010–2011

The reorganization of CEHS is now complete, and plans for 2010–2011 are to fully implement the changes in terms of center member participation in the Global Environmental Health Sciences Program, the Career Development Program, and the Integrative Health Science Facilities Core, in addition to the continued successful operation of COEC and the other facilities cores. Activities in the Global Environmental Health Sciences Program will

increase with the continuation of a program to host Thai graduate students in CEHS member laboratories for periods of three months to one year as part of an ongoing collaboration with the Chulabhorn Research Institute in Bangkok. The Integrative Health Science Facilities Core will begin considering applications for translational pilot projects in the coming year and will continue to provide center members with guidance on moving their research activities toward biological and clinical applications. The Career Development Program will initiate formal mentoring activities for junior members of the center that will complement departmental mentoring activities and enhance the participation of junior members in center activities. As always, CEHS leadership will continue efforts to engage the broader MIT community in research activities related to environmental health science.

Pilot Project Program

We will issue a call for pilot project proposals in July 2010, for funding to begin in September 2010. NIEHS awarded supplemental funding for this program. CEHS anticipates providing \$25,000 in direct-cost funding for two novel and innovative research projects related to environmental health issues. Priority will be given to projects that involve collaboration and have a likelihood of subsequent independent funding. If the center grant is funded for the 2011–2016 funding cycles, we anticipate issuing a further call for pilot projects in addition to the new Translational Pilot Project Program.

Career Development Program

The revamped Career Development Program will initiate several activities, including a program in which junior CEHS faculty will be mentored by more senior members. Furthermore, we will expand the Friday Forum series to include an annual session on grant-writing skills and a session providing a practical perspective on life in academic research and teaching for young scientists aspiring to careers in academia.

Community Outreach and Education Core Activities

COEC will continue the activities described earlier in conjunction with the staff of the Edgerton Center. These activities include MIT Museum events, teacher workshops, and the new workshop series for health care professionals in collaboration with CRC. The new two-day nurse workshop provides continuing education credits for nurses and broadens COEC's target audience. In the coming year, we also expect to take our teacher professional development workshop presentations to other institutions around the country.

Friday Forum Lecture Series

CEHS will continue our highly successful Friday Forum lecture series in which center members and CEHS pilot project recipients share their research programs in monthly presentations at an event designed to promote interaction among current members and attract new members to the center in an informal social setting.

External Advisory Committee

We will initiate plans for a meeting of the External Advisory Committee depending upon the outcome of the center's resubmitted competing renewal application, which will be known sometime in the fall term.

Poster Session

We will continue this successful activity again in 2010–2011.

Newsletter

Our goal is to continue publishing a newsletter twice each year. The fall 2009 and spring 2010 newsletters can be viewed online. All editions of the newsletters are distributed throughout the MIT community and can also be read online at <http://cehs.mit.edu/News.html>.

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More information about the Center for Environmental Health Sciences can be found at <http://cehs.mit.edu/>.