

# Whitaker College of Health Sciences and Technology

## Center for Environmental Health Sciences

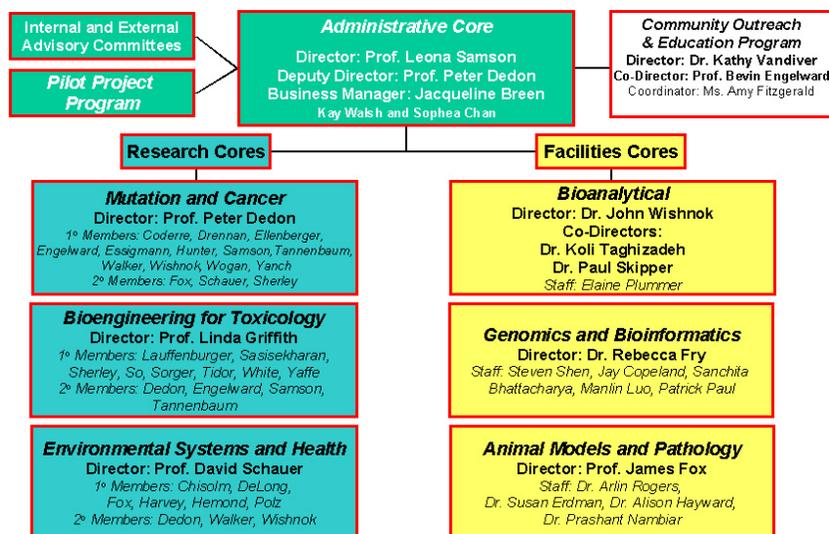
### Overview

The overriding goal of the Center for Environmental Health Sciences (CEHS) continues to be to study 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 29 faculty members who employ a diverse set of research tools to tackle problems relevant to environmental health sciences.

### Organization

As shown in Figure 1, CEHS continues to be comprised of an administrative core, the Community Outreach and Education Program (COEP), the Pilot Project Program, three research cores, and three facilities cores. Center membership currently consists of 29 faculty scientists and engineers, 27 from MIT and two from Harvard University (Ellenberger and Hunter), which represents a loss of three members (van Parijs, Christiani, Nepf) since 2003–2004 due to changing research interests. The members of the Administrative Core, which is charged with overall operation of the center, include Professor Leona Samson (Biological Engineering Division [BE]), director; Professor Peter Dedon (BE), deputy director; Ms. Jacqueline Breen, administrative officer; Ms. Sophea Chan, financial assistant; and Ms. Kay Walsh, administrative assistant. The COEP is responsible for the Center's outreach activities, which currently have an emphasis on K-12 education activities for teachers and students. The COEP is administered by Dr. Kathleen Vandiver, director; Professor Bevin Engelward (BE), codirector; Ms. Amy Fitzgerald, COEP coordinator.

Figure 1. Center for Environmental Health Sciences Organization Chart



Research in CEHS is organized into three research cores that build on the strengths of the center membership and reflect a vision for the future of environmental health research. These are (1) the Mutation and Cancer Research Core, (2) the Bioengineering for Toxicology Research Core, and (3) the Environmental Systems and Health Research Core. The theme of each core derives from the members' research interests, and all are linked by the center's overarching focus on defining the biological effects of exposure to environmental agents. The Mutation and Cancer Research Core, directed by Professor Peter Dedon, addresses the relationships between DNA damage, DNA repair, mutation, and cancer associated with exposure to environmental and endogenous chemical and physical agents. The Bioengineering for Toxicology Research Core, directed by Professor Linda Griffith (BE, Mechanical Engineering), was created to facilitate the development of new experimental tools and analysis methods relevant to environmental influences on human health, with a range of approaches that span the molecular-cellular-systems length scales. The mission of the Environmental Systems and Health Research Core, now directed by Professor David Schauer (BE), is to understand the relationships that link environmental processes and human health in terms of exposure to chemical agents as well as biota. This is most aptly illustrated by the triad of dependent interactions of aflatoxin, hepatitis virus, and human liver cancer, which has been a research foundation for the center since its inception nearly three decades ago.

Three state-of-the-art facilities cores reflect CEHS's new research directions. The cores are heavily used by center researchers, with each contributing to the research of at least 10 members. Under the direction of Drs. John Wishnok, Koli Taghizadeh, and Paul Skipper, 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. The core operates as a resource for the center, and it allows researchers to use the facilities as a service lab, for supervised analyses, or as fully trained users. The Genomics and Bioinformatics Facilities Core is directed by Dr. Rebecca Fry, who succeeds Professor Peter Sorger, and provides center members with 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 center research to higher levels of complexity in an attempt to understand the response of the whole organism to environmental influences. The Animal Models and Pathology Facilities Core, directed by Professor James Fox (Division of Comparative Medicine, BE), provides center members with the latest technology 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 tissue by histological and image analysis.

### **Accomplishments in 2004–2005**

The major accomplishment within CEHS this past year was the award of our National Institute of Environmental Health Sciences (NIEHS) Center Grant competitive renewal, now in its 26th year. This grant represents funding of \$8.5 million total costs over five years, with an annual budget of \$1.7 million (total), and provides for administration of the center, support for numerous outreach programs, and funding of four to six Pilot Project awards each year. These latter awards support novel research activities that

utilize multidisciplinary approaches to the study of environmental health sciences. Though we were unable to support Pilot Projects in 2004–2005, the renewal of the NIEHS Center Grant will allow us to offer four to six awards of \$15,000 to \$25,000 each in 2005–2006. This funding will also allow us to continue to support the CEHS Community Outreach and Education Program, which promotes community-level scientific literacy through a variety of programs targeted to students and their teachers from grade four through the undergraduate curriculum, as well as to continue to provide faculty with resources from both the research cores and the facilities cores.

With the NIEHS Center Grant in a no-cost extension as well as the renewal in April, CEHS maintained a strong volume of research support totaling \$7.1 million in 2004–2005. These research programs are funded through a variety of sources, including the National Institute of General Medical Sciences, National Cancer Institute, Department of Energy, National Science Foundation, American Cancer Society, and Defense Advanced Research Projects Agency.

The COEP continued its tradition of novel and substantive K-12 outreach activities with a variety of programs offered in 2004–2005, including the following:

- *Three Day Middle School Science Teacher's Workshop, June 23–25, 2004.* This pilot workshop involved five teachers from the Cambridge Public Schools and a program consisting of biology refresher lessons with the LEGO Life Science models in the mornings and enrichment and connections to environmental health sciences in the afternoons. There were presentations by Professors Bevin Engelward and Jeff Coderre, and teachers visited several MIT labs to learn about specific research techniques.
- *Environmental Health Lessons.* Katy Wack presented lessons on environmental health to Cambridge elementary school students every Thursday at East End House, a community after-school and summer program for elementary school children. The major event of the year involved a field trip to the MIT campus on November 16, 2004, during which 17 children visited a research lab and learned about the role of the liver in health and disease.
- *Summerbridge Cambridge: A Breakthrough Collaborative Program.* During fall 2004 (October 3, 10, 17 and November 2), COEP staff led a hands-on toxicology lesson adapted from the NIEHS curriculum "Chemicals, the Environment and You," for 60 Cambridge middle school students. This was followed by a fieldtrip to MIT on November 2 to visit a CEHS research lab.
- *Family Adventures in Science and Technology (FAST).* CEHS hosted an event at the MIT Museum on January 30, 2005, whose theme was "Your Genes and Your Environment." With 120 participants, presentations were made by Professors Bevin Engelward ("Glowing Mutated Mice") and John Essigmann ("Tales of the Peanut Butter Toxin") and guests also worked with LEGO DNA models directed by Dr. Kathy Vandiver ("LEGO My DNA, Please!").

- *Teachers as Scholars Program.* Our Genes and Our Environment was also the title of a two-day COEP seminar sponsored in conjunction with Harvard's Teachers as Scholars Program on February 9 and 16, 2005. Professors James Sherley and Doug Lauffenberger made presentations to 24 teachers in the morning and lab visits were scheduled in the afternoons.
- *Edgerton Center Outreach Activities.* Through the 2004–2005 school year, the MIT Edgerton Center hosted classes of Cambridge Public School students in grades 4 through 8 and students from other local urban and suburban school districts as well. Hands-on, 2.5-hour lessons included the following three CEHS-developed programs: Grungy Groundwater (fate and transport of pollutants), Living LEGOs (genetic variation and toxins), and Shape of Life (DNA, replication, and mutation). Living LEGOs is a new curriculum offering developed by CEHS during this year.
- *Northeast Community Outreach and Education Programs Summit.* CEHS participated in this event on May 17, 2005, which was hosted by eight NIEHS centers at the University of Medicine and Dentistry of New Jersey.

In addition to the many COEP activities, a major highlight of the center's activities in 2004–2005 was the Second Annual CEHS Poster Session. This annual event attracted 126 participants—comprised of CEHS members, students, postdoctoral scientists, and staff, as well as other MIT faculty members—who presented 51 scientific posters in an afternoon session at MIT. Feedback has been overwhelmingly positive in terms of promoting scientific exchange and collaborations, as well as introducing CEHS to the broader MIT community.

CEHS members received several major awards, honors, and appointments in 2004–2005: Professor Ed DeLong was elected to the American Academy of Arts & Sciences and was named Gordon and Betty Moore Foundation investigator; Professor John Essigmann was awarded the 2004 Princess Chulabhorn Gold Medal; Professor James Fox was elected to the Institute of Medicine; Professor Leona Samson was named to the National Academies' National Research Council Committee on Emerging Issues and Data on Environmental Contaminants and to the National Cancer Institute's Board of Scientific Counselors for Basic Sciences; Professor Peter So was awarded the MIT Francis Perkins Award; and Professor Gerald Wogan was awarded the 2005 Charles S. Mott Prize by the General Motors Cancer Research Foundation.

### **Administrative Changes**

In the past year, CEHS has undergone administrative changes with the departure of Ms. Gertraud Gillen, business manager. CEHS was fortunate to have Marilyn Smith from the vice president for research's office work temporarily with us in our daily operations and search for a new financial administrator. We are pleased to report the addition of Ms. Jacqueline Breen as the center's financial administrator. This year also saw the departure of COEP codirector Ms. Katharine Wack, and we were fortunate to recruit Dr. Kathy Vandiver as director of COEP. Professor Samson will step down as director and Professor Bevin Engleward will assume the role of codirector beginning July 1, 2005. This year also saw a change in leadership of the Genomics and Bioinformatics Facilities Core, from Prof Peter Sorger to Dr. Rebecca Fry.

## **Plans for 2005-2006**

### ***Pilot Projects***

CEHS will continue its long-standing and successful Pilot Project Program, whose specific goals are to: (1) provide initial support for new investigators to establish environmental health projects, (2) allow exploration of possible innovative new directions representing a significant departure for established investigators in environmental health sciences, and (3) stimulate investigators from other areas of endeavor to apply their expertise to environmental health research. A call for proposals will be issued in August and we anticipate funding in January 2006. We expect to provide \$15,000 to \$25,000 for four to six novel and innovative research projects related to environmental health issues. Priority will be given to projects likely to receive subsequent independent funding. Also, CEHS will coordinate its Pilot Project Program with that of the Woods Hole Oceanographic Institute's (WHOI) Center for Oceans and Human Health, which is jointly sponsored by the NIEHS and National Science Foundation and has several areas of research complementary to CEHS.

### ***Community Outreach and Education Program Activities***

COEP will continue the activities described earlier with the additional development of new Edgerton Center teaching activities, such as MIT Museum events, Teachers Workshops, and Teachers as Scholars sessions. We will also begin new programs involving teachers and students from the John D. O'Bryant School of Mathematics and Science. This Boston public school is comprised of 7-12-grade students who follow a curriculum enriched in math and science.

### ***Friday Forum***

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

### ***CEHS Retreat***

We will initiate our annual one-day retreat for center members on July 18th at the MIT Endicott House. This annual event will provide an opportunity to highlight ongoing research and new core innovations and technology, particularly with regard to science and engineering projects and programs driving center research, as well as promote interactions among center members.

### ***CEHS Poster Session***

We will continue this successful activity again in 2005–2006. We will attempt to coordinate this with the WHOI Center for Oceans and Human Health to promote interaction among members of these two research groups.

**Leona D. Samson, Director, Professor of Biological Engineering**

**Peter C. Dedon, Deputy Director, Professor of Biological Engineering**

*More information about the Center for Environmental Health Sciences as well as upcoming events can be found online at <http://mit.edu/cehs/>.*