

The David H. Koch Institute for Integrative Cancer Research at MIT

Goals, Objectives, and Priorities

The [David H. Koch Institute for Integrative Cancer Research](#), a National Cancer Institute (NCI)–designated cancer center, provides a state-of-the-art research facility and collaborative environment for cancer research on the MIT campus. Completed in 2010, the Koch Institute (KI) building allows for the physical co-localization of faculty members from the Department of Biology and a variety of departments in the MIT School of Engineering. This multidisciplinary group of investigators is at the core of the Koch Institute’s mission: to combine cancer science and cancer-oriented engineering to develop new insights into cancer as well as new tools and technologies to better treat, diagnose, and prevent the disease.

As a group, our goal is to make the Koch Institute the gold standard in interdisciplinary disease-focused research. The organization is continually expanding a highly effective [relationship network](#) that involves other academic and clinical oncology centers, industrial partners, and cancer-focused individuals and foundations. As part of an institution of higher education, we are also deeply committed to [training](#) the next generation of cancer researchers. Many of our efforts this past year have been focused on further strengthening internal and external communications and collaborations.

Finances and Funding

Funding for research performed within the KI building comes from several sources, including federal grants, philanthropic gifts, and industrial contracts. The total was approximately \$70 million in FY2014. This figure is based on intramural faculty expenditures and includes total sponsored research volume, philanthropic funding, funding for five Howard Hughes Medical Institute faculty members, corporate funds, faculty discretionary account spending (typically chair accounts), postdoctoral and graduate fellowship funding through MIT mechanisms, core facility chargeback accounts, and MIT general budget allocations to KI. Also included are funds managed by KI for specific cancer research efforts across MIT.

Given the interdisciplinary nature of the research conducted at the Koch Institute, several faculty members participate in multi-investigator collaborative projects, many of which are funded by grants from NCI. This work is performed through the Physical Science and Oncology Center, the Center of Cancer Nanotechnology Excellence, the Tumor Cell Network Center (formerly the Integrated Cancer Biology Program), and the Tumor Microenvironment Network as well as at the centers and companies highlighted below.

The Ludwig Center for Molecular Oncology, established in 2006 with a gift from the Ludwig Trust and housed within the Koch Institute, continues to support several investigators working in the area of metastasis research. In January, KI received a \$90 million gift from the Ludwig Trust to add to the endowments created in 2006. These funds support the Ludwig Center, several KI faculty, and fellowships for students and postdocs working in metastasis.

The Bridge Project provides additional opportunities for faculty members to develop research toward clinical and commercial applications through collaborations with clinical partners. The project—a collaboration with the Dana-Farber/Harvard Cancer Center (DF/HCC)—is designed to foster and support interinstitutional cancer research efforts between faculty at MIT and Harvard. Now in its fourth year of funding, the project has supported 12 teams of investigators from KI and DF/HCC in developing new treatment and diagnostic methods for a variety of cancers. The project is funded solely by philanthropic funds, which have been raised in a collaborative fashion between the development organizations of DF/HCC and KI. There are also several Bridge Project events each year, including workshops and donor events.

In addition to several smaller-scale sponsored research relationships with companies, KI has established a larger-scale partnership with Janssen Pharmaceuticals, the pharmaceutical division of Johnson & Johnson. TRANSCEND is a five-year collaborative agreement that fosters oncology research and technology development in cancer diagnostics, novel therapeutic targets, drug delivery systems, cancer immunotherapies, and murine disease models to study premalignancies, tumor progression, and target validation. The program entered its fifth funding cycle in June 2014, and 18 projects and one pilot project have been funded thus far. Currently 14 projects are active, and 14 MIT faculty members are receiving support; three additional projects will receive funds in July 2014. The program offers the opportunity for visiting scientists from Janssen to work in MIT laboratories as well as for regular consultations with company scientists. Faculty members, trainees, company scientists, and members of the Johnson & Johnson Boston Innovation Center are invited to two yearly scientific exchange events, one at KI and one at a Janssen facility.

Personnel Information

Over the past year, the Koch Institute welcomed three new intramural faculty members and a new clinical investigator. In conjunction with the Department of Biology, KI concluded a search for a new faculty member, and Dr. Ömer Yilmaz will begin in September 2014. In conjunction with the Department of Biological Engineering, Dr. Angela Koehler was hired and started early in 2014.

MIT president emerita and professor of neuroscience Susan Hockfield, a staunch advocate for the convergence of engineering and life sciences, joined KI as an intramural member in fall 2013. Dr. Hockfield also serves as the faculty chair of the KI Leadership Council.

Dr. Peter Ghoroghchian began as a new KI clinical investigator in September 2013.

By fall 2014, the Koch Institute building will house 28 faculty members—14 from the Department of Biology, 13 from the School of Engineering, and the president emerita—as well as three clinical investigators.

KI also includes 25 MIT faculty who are extramural members, including the directors of the Whitehead Institute (David Page) and the Broad Institute (Eric Lander). Through their involvement in research on cancer or cancer-related subjects, these individuals participate in a variety of ways in the research activities of the Koch Institute.

The Swanson Biotechnology Center, which includes the core facilities of KI, is available not only to the KI faculty but also to the whole of MIT. At full capacity, the center will employ approximately 70 full-time staff scientists working within 13 distinct core facilities.

At the end of December 2013, 171 graduate students and 170 postdoctoral fellows or associates had active appointments in KI building faculty laboratories. KI's total personnel count exceeds 750.

Faculty Honors and Awards

Robert Langer won the Kyoto Prize for Advanced Technology in the Biotechnology and Medical Technology category. Langer also received the Breakthrough Prize in Life Sciences, the RUSNANOPRIZE Nanotechnology International Prize (along with BIND Therapeutics, which he cofounded), and the Biotechnology Heritage Award. KI director Tyler Jacks received the 2014 Award of Excellence in the basic science category from The Hope Funds for Cancer Research. Richard Hynes was elected as an American Association for Cancer Research fellow. Angelika Amon received the 2014 Genetics Society of America Medal for her contributions to uncovering key principles of the cell cycle and cell division. A team led by KI faculty member Darrell Irvine, along with Dana-Farber Cancer Institute investigators, received the Melanoma Research Alliance Team Science Award in recognition of their efforts to optimize T cell-targeting nanoparticles for improved melanoma treatment.

KI members Daniel Anderson and J. Christopher Love were awarded tenure by the Department of Chemical Engineering. Extramural member Laurie Boyer was awarded tenure by the Department of Biology. Forest White was promoted to professor of biological engineering, and Matthew Vander Heiden was promoted to associate professor of biology.

Publications, Patents, and Companies

Over the past seven years, 20 companies have been started by KI faculty as a mechanism for discoveries in new technologies to be brought to the marketplace. For example, BIND Therapeutics, a nanomedicine technology endeavor launched in 2007, is now treating phase II clinical trial patients.

KI researchers produced more than 475 publications in FY2014, almost 20% of which have multiple KI faculty members as authors. A solid indicator that cross-disciplinary collaborations are occurring was the doubling of the number of publications resulting from biology-engineering collaborations. This number is expected to continue rising over the coming years.

With an intense focus on developing new solutions to the complex challenges of cancer, the Koch Institute at MIT assembles world-class interdisciplinary researchers in an institute dedicated entirely to cancer research. As a state-of-the-art cancer research and technology facility, the Koch Institute is clearly—and quickly—changing the landscape of cancer research.

Additional Accomplishments

In 2014, KI ran a series of workshops and other activities aimed at community building, with the goal of strengthening integration and furthering interactions between scientists and engineers as well as exposing researchers to the clinical, patient-based side of cancer work.

- *Celebrating 40 Years of Cancer Research:* This year was particularly important to the KI community, as 2014 marked the anniversary of 40 years of cancer research at MIT; Nobel laureate and MIT professor Salvador Luria founded KI's predecessor organization, the MIT Center for Cancer Research, in 1974. KI celebrated the anniversary with a reception that saluted advances made by members of MIT's cancer research community.
- *Oncology Seminar Series:* Now in its second year, this cancer-specific seminar series at MIT invites top-level cancer researchers and clinicians to present their work and meet with faculty and researchers at the Koch Institute. The seminars have been well attended and have received very favorable reviews.
- *Yearly Fall Retreat:* The purpose of this retreat is to provide an off-campus opportunity for sharing lab research and highlighting new research areas through formal presentations, poster sessions, and casual events.
- *Friday Focus:* This internal weekly seminar series has broken down language barriers and become a very successful cross-disciplinary educational/training platform for presenting recent data from each of the KI labs.
- *Crossfire:* This in-house lecture series is designed to bring our two major constituencies closer together. Biology lectures cover the basics of key areas of cancer biology, while engineers present lectures on trends in materials, tissue engineering, and nanoparticles. Graduate students and postdoctoral fellows present broad-scope lectures explicitly designed to reach across disciplines.
- *The Doctor Is IN:* Presented by MDs, this event exposes researchers in the building to real clinical issues, including patient case studies and new treatments being tested in the clinic.
- *Core Facility Open Houses:* Koch Institute core facilities open their doors to KI and MIT researchers to give a glimpse at services provided and to allow opportunities to ask questions and discuss projects.
- *Committee for Community Life:* KI volunteers (trainees, staff, researchers, and administrators) organize community-building events and the seminars/lectures listed above. They also discuss other issues of importance to postdocs and graduate students.
- *Cancer Community Newsletter:* This electronic newsletter, published since 2009, sends news and highlights of KI members' achievements, awards, and publications to current and past KI members.
- *Community Breakfast:* KI held a breakfast in January 2014 to celebrate all members of its cancer research community, including undergraduates, graduate students, postdocs, faculty, clinical investigators, and staff. Several speakers, representing all of these groups, shared personal accounts of their careers in cancer research, how cancer has affected their own lives, and the importance of the KI community.

KI also focused on outreach beyond our research community. The following are some examples.

- *KI Cancer Solutions Newsletter*: This electronic newsletter sends highlights of newsworthy achievements, awards, and publications of KI members to over 2,500 readers with an interest in the Koch Institute.
- *Koch Institute Public Galleries*: The galleries were established to connect the community in Kendall Square and beyond with work being done at the cutting edge of cancer research and, more generally, with life sciences work at MIT. Within the galleries, visitors can explore current cancer research projects, examine striking biomedical images, hear personal reflections on cancer and cancer research, and investigate the historical, geographical, and scientific contexts from which the Koch Institute emerged. The galleries are free and open to the public on weekdays from 8 am to 6 pm (4 pm on Fridays). They are also a featured stop on the Cambridge Historical Society's new "Innovations of Cambridge" tour, which began in April 2014. New exhibits are unveiled regularly, including the annual exhibition of winning biomedical images from the Koch Institute Image Awards. Several Image Awards submissions were also featured in the Museum of Science's Hall of Human Life, which opened in fall 2013.
- *with/in/sight Lecture Series*: Initiated in September 2011, this public lecture series features the insights that emerge when science meets engineering, clinical practice meets urgent patient needs, entrepreneurial drive meets venture capital, and imaging technology meets artistic vision. Four with/in/sight events were held over the past year with a total attendance of more than 650: a lecture with the MIT Club of Northern California on cancer genetics and precision therapy, a program featuring women on the front lines of the fight against cancer, a showcase of Bridge Project-funded pancreatic cancer research, and the KI Image Awards presentation.
- *Annual Symposium*: The 13th annual Summer Symposium, "RNA Biology, Cancer and Therapeutic Implications," was held on June 13, 2014. More than 1,200 cancer researchers, RNA biologists, and clinical oncologists convened at sold-out Kresge Auditorium to hear updates on the latest breakthroughs in the creation of RNA-based gene-editing tools and the development and intracellular delivery of RNA-cancer medicines.
- *One-on-One: Linnea Duff & Anna Farago*: In December 2013, cancer patient and advocate Linnea Duff joined thoracic oncologist and Koch Institute postdoctoral researcher Anna Farago in an intimate conversation about the powerful impact cancer research can have in patients' lives and how the possibility of such an impact drives the passion and commitment of researchers and staff working at KI and other cancer research institutions.

- *School Group Programs:* The Koch Institute is committed to fostering an interest in science and engineering among young people. As part of this mission, we invite groups of middle and high school students (grades 7–12) to visit our facilities, meet researchers who work every day to solve cancer problems, and learn interactively about the science and technology of cancer research. Over the past year, we hosted 25 school groups (608 students) and two professional development programs for educators (50 participants), presenting hands-on demonstrations of work in the building and making full use of the teaching resources in the Koch Institute Public Galleries. These events are offered free of charge and can optionally be paired with other activities at MIT, including life sciences and engineering workshops at the MIT Museum. The Koch Institute education outreach program regularly participates in other MIT programs for students and teachers, including those run by the Office of Engineering Outreach Programs, the Scheller Teacher Education Program, and the Department of Biology.
- *Community Outreach Activities:* The Koch Institute hosted its third annual biology-themed flash mob during the Cambridge Science Festival, showcasing cancer immunotherapy research coming out of KI laboratories (180 participants) as well as hands-on demonstrations for the Girl Scouts STEM Expo (50 participants). In June, KI hosted a TEDxCambridge simulcast and the event's Innovation Lab, which showcased local innovators and entrepreneurs, including KI researchers. The TEDx event brought hundreds of people through KI's doors and into the Public Galleries.

Administrative Initiatives

The Koch Institute's administrative goal is to support and facilitate the work of Koch Institute researchers. This year several initiatives have been implemented or improved on.

The KI intranet system continues to be developed for maximum efficiency and use. The intranet serves as a repository for calendars, handbooks, guides, forms, and videos of past seminars and provides key administrative, event, and scientific information to members of the Koch Institute. In addition, KI is developing new, easy-to-manage websites for faculty laboratories. These websites will provide for a more coordinated and cohesive KI brand and visual identity while enabling labs to better communicate about their research.

The Scientific Advisory Board provides key scientific input to KI as an NCI-designated cancer center. In May 2014, we submitted the five-year competitive renewal for years 45–49 of this designation. As part of the submittal, we will present our work to an NCI site visit team at the end of October. The board's input plays a critical role in the process.

The Koch Institute Leadership Council is a group of friends and benefactors—primarily individuals from the biotechnology, pharmaceutical, entrepreneurship, and philanthropy communities—who generously contribute their time, energy, and personal

resources to advancing the work of the Koch Institute. Many of the members have strong connections to MIT, and nearly all have been touched by cancer. Combining professional expertise and personal commitment, members provide valuable advice and support to KI leaders as they seek to strategically expand the scope of research, education, public outreach, communications, and fundraising programs.

Tyler Jacks

Director

David H. Koch Professor of Biology