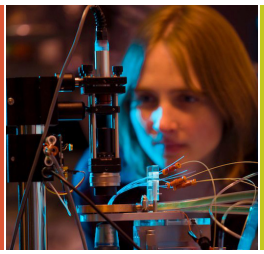
KOCH INSTITUTE FAQs



web.mit.edu/ki cancer@mit.edu 617.253.6403

77 Massachusetts Ave. Building E17-110. Cambridge, MA 02139

1. What is the Koch Institute?

The Koch Institute grows out of and transcends the MIT Center for Cancer Research (CCR), which was founded in 1974 by Nobel Laureate and MIT Professor Salvador Luria. It is one of eight National Cancer Institute-designated basic (non-clinical) research centers in the U.S. Our mission is to apply the tools of science and technology to understand how cancer is caused, progresses and responds to treatment. We bring together scientists and engineers to discover how the disease behaves at a molecular level and to work on solving real cancer-related problems. The Koch Institute is both a physical entity and an organizing body for MIT's cancer research community at large (over 500 researchers across the Institute). It grows out of MIT's proven strengths in molecular biology, genetics, cell biology and immunology and stimulates extensive collaboration. The Koch Institute and its extramural partners comprise over 40 member laboratories from 7 departments.

The Koch Institute boasts an illustrious membership—

- 2 Nobel Laureates currently: Horvitz, Sharp
- 3 Nobel Laureates are former members: Salvador Luria, David Baltimore, Susumu Tonegawa
- 14 members of the National Academy of Sciences: Eisen, Hopkins, Horvitz, Housman, Hynes, Jaenisch, Lander, Langer, Lindquist, Lippard, Lodish, Orr-Weaver, Sharp, Weinberg
- 6 current and former faculty have been awarded the National Medal of Science: Baltimore, Langer, Lippard, Luria, Sharp, Weinberg
- 5 Howard Hughes Medical Institute Investigators: Amon, Bell, Horvitz, Hynes, Jacks

2. How is the Koch Institute affiliated with MIT?

The Koch Institute serves an important function as an organizing body for cancer research at MIT. The Koch Institute supports faculty members from various departments, including Biology, Chemistry, Mechanical Engineering and Biological Engineering. Koch Institute faculty teach classes at MIT, as well as train graduate & undergraduate students and postdoctoral fellows in their research laboratories.

3. What is Koch Institute's affiliation to the National Cancer Institute (NCI)?

The Koch Institute is one of eight National Cancer Institute-designated basic research centers. The Center interacts directly with the NCI and the ~60 other Cancer Centers nationally. This includes through advisory committees to the NCI and through strategic planning meetings. For more information please visit the NCI-Cancer Centers website.

4. Does the Koch Institute see patients or conduct clinical trials?

The Koch Institute is a basic cancer research center that is not affiliated with any hospitals or clinics. Our researchers collaborate extensively with clinicians at other institutions, but we do not conduct our own clinical trials. Rather, our mission is to apply the tools of basic science and technology to understanding how cancer is caused, progresses and responds to treatment. Our history of success underscores our belief that elucidating the fundamental biological processes underlying cancer will lead to better treatment of the disease. Powerful new anti-cancer agents (e.g. Gleevec and Herceptin) have been developed based on discoveries made in the Koch Institute.

5. Do Koch Institute researchers examine patient cases?

Increasingly, Koch Institute researchers are working with material derived from cancer patients in experiments aimed at understanding a patient's drug response or specific disease state. This is typically done in an "anonymized" fashion to protect patient confidentiality.

6. What is the difference between basic and clinical research?

Clinical cancer research deals directly with cancer patients (e.g. a clinical trial of an experimental anti-cancer agent). Basic cancer research is a broad term that typically means research related to the molecular basis of cancer, including the biological processes that are affected during tumor development. Basic cancer researchers might use patient material in their research but often use other experimental systems in addition or instead. For example, basic cancer researchers in the Koch Institute use experimental systems ranging from the laboratory mouse to fruit flies, and even single-cell yeast. Because of the evolutionary conservation of fundamental cellular processes, the information gained from the study of these experimental organisms is highly relevant to our understanding of normal human cells and human cancer cells.

To achieve our goals to better detect, diagnose, monitor, and control cancer, we must apply our expanding understanding of cancer biology to find diagnostic and therapeutic breakthroughs that directly impact the lives of cancer patients. For example, by identifying the molecules Abl and Her2/neu as potential targets for cancer therapy, MIT researchers helped lay the groundwork for the development of the first molecularly-targeted cancer drugs Gleevec (imatinib) and Herceptin (trastuzumab) approved by the FDA in 1998 and 2001.

A critical step is the evaluation of the importance of laboratory findings in human cancer material or cancer patients. To this end, many Koch Institute cancer researchers have collaborative projects with researchers and/or clinicians in clinical research centers.

Importantly, we (and the NCI as well) define clinical/translation activities in cancer to include not just direct clinical studies but also technology development and commercialization. A great strength of MIT is the promotion of its discoveries into the commercial sector. Through the MIT Technology Licensing Office, numerous recent discoveries by MIT cancer researchers — involving subjects as diverse as RNAi technology to animal models of cancer to methods for improved cancer vaccines — have been licensed to companies worldwide. Several of our Koch Institute faculty members have been instrumental in the founding of companies, many in biotechnology with specific interests in cancer. Still more are members of scientific advisory boards or consultants to cancer-focused biotechnology and pharmaceutical companies.

7. Do Koch Institute researchers focus on specific types of cancer (e.g. Breast or Brain Cancer)?

Koch Institute researchers work on a variety of cancers; however, the focus of the research is on understanding the mechanisms by which normal cells are converted into cancer cells and more basic principles of tumor development. Most of these mechanisms are affected in a variety of cancer types. Consequently, the discoveries made in the Koch Institute are widely applicable and lay the groundwork for the improvements in treatment and diagnosis quite broadly. Particular investigations may involve models of certain cancer types or use actual patient material.

8. How can a non-medical institution carry out medical research?

This question arises out of the misconception that cancer research must be performed on cancer patients (or at least on material derived from cancer patients). However, because cancer is fundamentally a disease of cells gone awry, it is possible to study the important factors governing cancer development and progression by studying cells in the laboratory or in the cells of other organisms. Indeed, many of the key discoveries that have guided our understanding of human tumor development have come from investigators, including many from MIT, performing non-clinical (or "basic") cancer research. Importantly, these discoveries are not purely academic in nature: they form the basis for improved methods to diagnose and treat the cancer.

Our new approach, integrating the efforts of world-class biologists and engineers focused on the cancer problem, will change the course of cancer research.

The initial strategic research plan for the Koch Institute revolves around five target areas critical for rapid progress toward controlling cancer. Research and development in each of these target areas involves cross-disciplinary teams of faculty, students, and staff and will also encompass collaborations with clinical centers and industry. These areas — nanotech therapy, cancer detection and monitoring, metastasis, understanding cancer pathways, and engineering the immune system — are key to impacting the lives of people with cancer.

9. What distinguishes the Koch Institute from other basic cancer research organizations?

The Koch Institute is different from other cancer centers, in that it brings together scientists and engineers focused on cancer. The real power is in having cancer biologists that are expert in the disease, working on trying to understand the disease at a molecular level, interacting closely with engineering faculty with an interest in solving cancer-related problems. There are other NCI-designated basic science cancer centers besides our own, but none with the composition of world-class interdisciplinary investigators that the Koch Institute has.

An example is in the area of nanotechnology, where we are hoping to develop a new generation of anti-cancer agents that are more powerful because they can selectively target cancer cells, as opposed to normal cells. That will be enhanced still further in the future by taking advantage of new information from biological studies regarding how to shut off any gene of interest. This takes advantage of a process called RNAi, which has only been discovered in the past decade. These kinds of collaborations highlight the importance of having scientists who are knowledgeable about the disease and knowledgeable about biology working with engineers who want to develop new tools, new materials, new devices, that can be used to better diagnose or better control the disease.

10. What are some of the key discoveries that have come from the Koch Institute?

Identified the molecules that led to two of the first FDA-approved, molecularly-targeted anti-cancer drugs — Herceptin, approved by the FDA in 1998; and Gleevec, approved in 2001.

Nobel Prize-winning work —

- Discovered that genes are encoded in discontinuous segments of DNA and are assembled by a process called mRNA splicing;
- Pioneered the understanding of the genetic basis of apoptosis, or programmed cell death, which has gone awry in certain cancers;
- Uncovered critical aspects of lymphocyte structure and function, furthering our understanding of the role of the immune system in cancer.
- Isolated the first human cancer genes.

Other critical achievements:

- Discovered extra cellular matrix components and their receptors, which play a critical role in metastasis.
- Contributed to the sequencing of the human genome.
- Developed novel materials for sustained delivery of anti-cancer drugs.

11. Who does the Koch Institute train?

The Koch Institute provides unique training and educational opportunities for undergraduate and graduate students, and postdoctoral researchers.

Postdoctoral researchers (Postdoctoral Associates and Postdoctoral Fellows), or "postdocs" as they are familiarly known, hold doctoral degrees from all over the country and the world, and come to the Koch Institute to pursue research and training under the guidance of a faculty member.

Graduate students working with investigators in the Koch Institute are admitted primarily through MIT departments including Biology, Biological Engineering, Chemistry, Chemical Engineering, Materials Science & Engineering. Graduate students are an integral part of the Koch Institute's research labs and work closely with faculty members to pursue some of the most exciting areas of research in cancer and related fields.

Undergraduate students from across the campus have the opportunity to collaborate with Koch Institute faculty through the MIT Undergraduate Research Opportunity Program (UROP). The program allows students to gain hands-on experience in a laboratory setting while pursuing their research projects.

12. Do Koch Institute faculty have connections to local companies and hospitals?

Most Koch Institute investigators are actively collaborating with one or more investigators at clinical research centers and hospitals, and many investigators have joint research funding with more clinical investigators. These interactions range from basic research collaborations to more translational cancer research. Moreover, many Koch Institute researchers receive research funding from industrial sources through sponsored research agreements, and several more serve as advisors to bio-pharmaceutical companies located in the greater Boston area and throughout the country.

13. How does the Koch Institute fund its research?

The Koch Institute has benefited from private philanthropic support, including important gifts from David H. Koch '62, the Virginia and D.K. Ludwig Fund for Cancer Research, and major foundations including the Howard Hughes Medical Institute. It is vital for the Koch Institute to draw upon the support of individuals, corporations, and foundations to achieve its full plan of discovery and translational research.

Furthermore, the Koch Institute has received major funding from the NIH, particularly the NCI. In addition to the NCI Center grant, the Koch Institute has successfully competed for several multi-investigator grants, including the Mouse Models of Cancer Consortium, the Integrative Cancer Biology Program, and the Centers for Excellence in Nanotechnology and Cancer.