The Koch Institute for Integrative Cancer Research at MIT was founded in 2007 and opened at its current facility on March 4, 2011. By combining the biology faculty of the former MIT Center for Cancer Research with cancer-oriented engineers drawn from across the MIT School of Engineering, the Koch Institute continues a tradition of scientific excellence while directly promoting innovative solutions for the improved detection, monitoring, treatment, and prevention of cancer.

The Koch Institute Public Galleries were established to connect the community in Kendall Square and beyond with the work of the Koch Institute. Within the Galleries, visitors can explore current research projects, examine striking biomedical images, hear personal reflections on cancer and cancer research, and investigate the historical, geographical, and scientific contexts out of which the Koch Institute emerged. Further information about the work of the Koch Institute is available online at ki.mit.edu.

The Koch Institute is deeply grateful to Charles B. and Ann Johnson for their generous gifts establishing the Philip Alden Russell (1914) Gallery at the Koch Institute and providing ongoing support for exhibit revitalization.
A Human Endeavor

Cancer is personal. No statistic can convey the hardships that cancer patients and their families endure; no publication can summarize the lifelong efforts of cancer researchers. This video installation explores diverse personal perspectives on cancer and cancer research through an ongoing interview series.

“We will make important discoveries. We will develop new technologies. But at the end of the day we will impact patients’ lives. And for me, it will be especially satisfying when we’re able to connect very directly from discoveries in our laboratories to better outcomes for patients.”

“In the midst of my Ph.D. studies, my father was actually diagnosed with prostate cancer. You just think about cancer in the abstract as this beast that you’re clawing against and trying to slay. But when it becomes kind of a more personal thing and a more personal concern, I think you realize the impact that it has.”

“Five and a half years in, my husband still can’t say the word cancer. I own it. Yes, I have cancer. And that’s okay. It’s not great. I’d prefer not to. But at the same time, life goes on.”

“I’ve had several phone calls from people that I don’t even know that have been staring at this cancer thing either like a four year old child or a 25 year old child, and they’ve had no good news at all. They hear a little bit about what’s going on at MIT, and they’ve called me and want to hear some of the story because this is some good news. We’re not going to solve it this afternoon, but MIT’s resources with science and engineering are really honing in on this thing, and it seems to mean quite a bit to a lot of people.”

“If there’s any message I try to get across to people when I meet them, it’s that things might not be as bad as you might expect. We’re doing better. We’re making progress. We have a much better understanding of what causes cancer, and not only general cancers but individual patients’ tumors. And now we have drugs that can target some of those weak areas.”

“It was when I was in fifth grade that my teacher walked into the room and said, “Okay boys and girls, close your books. We’re going to talk about, ‘What is life?’” I remember after an hour of that discussion, of trying to figure out what the heck life was, I was just so astonished. I thought, ‘Gee, this is really cool.’ And I don’t think I ever stopped wondering about it from that moment on.”
A Convergent Moment

It is no coincidence that the Koch Institute’s cross-disciplinary approach to cancer has emerged first at MIT, where both engineering and science have thrived since 1861. This exhibit reflects on the rich parallel histories of these disciplines during MIT’s first 150 years. The timeline is unfinished; it closes with an opening, anticipating many more milestones to follow.
Cancer Research Stories

What do cancer researchers do? What tools do they use? What questions do they try to answer? This exhibition samples five current stories of cancer research at the Koch Institute through a series of interactive animations. Each story aligns with one of the Koch Institute’s research focus areas. Alongside the animations, the material culture of 21st century cancer research is displayed through a selection of objects from Koch Institute laboratories. These include specimens, devices, models, and other samples of the work of a cancer researcher.

NANO-BASED DRUGS
DETECTION AND MONITORING
METASTASIS
PERSONALIZED MEDICINE
CANCER IMMUNOLOGY

The Koch Institute is in the heart of Kendall Square, a center of innovation and commerce since the nineteenth century. Formerly a thriving home for the manufacture of everything from rubber to chocolate and soap, Kendall Square today hosts more than 150 high-tech companies, including some of the most esteemed technology, biotech, and pharmaceutical companies in the world. The Koch Institute itself is sited in the former location of the United-Carr Fastener Corporation, a manufacturer of metal parts for clothing and automobiles.
Capturing the Life Sciences

Scientific data come in many flavors and types, but a special place is reserved for images. Micrographs, MRI scans, and other biomedical images serve as windows through which experts and non-scientists alike can glimpse otherwise invisible biological worlds. The advancement of imaging technologies through science—and of science through imaging—exemplifies the progress that can be made at the interface of biology and engineering.

The annual Koch Institute Image Awards were established to recognize and publicly display these extraordinary visuals. From more than 120 submissions to the 2017 contest, ten winning images were selected by a panel of expert judges to appear in the Galleries.

2017 SELECTION PANEL
Alissa Ambrose
Senior Photo Editor, STATnews
Marie Bao, PhD
Editor, Developmental Cell, Cell Press
Catherine Draycott
Head of Wellcome Images, The Wellcome Trust
David Edwards, PhD
Founder and Director, LeLaboratoire and ArtScience Labs
Gordon McKay Professor of the Practice of Idea Translation, Harvard University
Janis Fraser, PhD ’76 (VII)
Principal, Fish & Richardson, P.C.
Member, Koch Institute
Director’s Council
Dan Hart
Senior Developer, WGBH
Anne E. Havinga
Estrellita and Vousof Karsh
Senior Curator of Photographs, Museum of Fine Arts, Boston
Bethany Millard
Executive Producer, Phosphorus Productions
Chair, MIT Corporation
Partners Program
Mandar Deepak Muzumdar, MD
Postdoctoral Fellow, Jacks Lab, Koch Institute at MIT
Instructor in Medicine, Harvard Medical School
Attending Physician, Dana-Farber Cancer Institute

2017 WINNERS

MAKING WAVES:
DELIVERY FOR AGELESS SKIN
Carl Schoellhammer, Denitsa Milanova, Humberto Trevino, Cody Cleveland, Jeffrey Wyckoff, Anna Mandinova, Giovanni Traverso, Robert Langer, George Church
Koch Institute at MIT, Harvard University, MGH

What if ultrasound (best known for applications in medical imaging and diagnostics) could be used to deliver age-reversing gene therapy to cells?

New technology from the Langer Lab, developed in partnership with Harvard’s Church Lab, drives non-invasive sound waves carrying genetic material through protective layers of skin, seen from top to bottom in these three images. The grey flecks show areas of successful gene transfer to cells, whose genetic clocks have been turned back by the nucleic acids they have received.

SNAP ChAT:
A FLATWORM CREATES A NEW PROFILE
Samuel A. LoCascio, Kutay Deniz Atabay, Peter Reddien
Whitehead Institute

The planarian flatworm shown here possesses a remarkable ability to regenerate complex tissue structures lost to injury, including a brain and eyes. Each color represents a different layer of neurons in the head, revealed by expression of the choline acetyltransferase (ChAT) gene. Not shown in this image are the abundant stem cells that give rise to a new central nervous system as the flatworm regenerates. The Reddien Lab studies planarians to illuminate the cellular and molecular basis of regeneration.
MICROFLUIDICS FOR THE MASSES: MEASURING CELL GROWTH RATES
Selim Olcum, Nathan Cermak, Scott Manalis
Koch Institute at MIT

To understand cancer cells’ response to therapy, the Manalis Lab measures how their masses change while exposed to drugs. The fluid-filled channels (bottom) connect tiny mass sensors in the form of hollow diving boards (top) whose vibrations precisely reveal the mass of individual cells passing through them. As treated cells flow across the array of sensors, each cell is weighed multiple times, thereby revealing the rate at which individual cells change their mass. Researchers are now starting to use tumor cell measurements to predict optimal treatment strategy for individual patients.

DOWNSTREAM DREAMS: INVESTIGATING MELANOMA IN A ZEBRAFISH
Dahlia E. Perez, Jacqueline A. Lees
Koch Institute at MIT

Like a pebble dropped into a pond, a single genetic mutation can trigger a ripple of biological consequences, including cancer. The Lees Lab uses various model systems to track the progression of cancer from origin to disease. Here, a close-up view of melanocytes in zebrafish gives insight into the organization of these cells in their normal state. Next, biologists will mutate a single gene, a known initiator of uveal melanoma, and study the cells throughout zebrafish development to determine the downstream effects of this single mutational event.

TINY TROJAN HORSES: TUMOR-PENETRATING NANO PARTICLES INFILTRATE CANCER CELLS
Liangliang Hao, Srivatsan Raghavan, Emilia Pulver, Jeffrey Wyckoff, Sangeeta Bhatia
Koch Institute at MIT

You can lead a nanoparticle to tumor cells, but you can’t make them shrink—at least not until the particle gets inside. This image shows biocompatible nanoparticles (yellow) inside clusters of pancreatic cancer cells (pink). The particles’ two-peptide uptake system—one to target the tumor, the second to penetrate it—was specially designed to overcome known difficulties in treating pancreatic cancer, but the Bhatia Lab hopes to expand the use of this modular delivery system for other cancer types as well.

MIND THE GAP: STUDYING THE TUMOR EXTRACELLULAR MATRIX
Steffen Rickelt, Richard Hynes
Koch Institute at MIT

Although the brightly colored cells in the center of this image catch your eye first, it’s the seemingly neutral tissue around them that the Hynes Lab is studying. Does this extracellular matrix serve as a barrier or a doorway to metastasis? When cancer cells spread to distant organs, they must navigate a complex network of cells and proteins to get there. This image shows colon cancer metastases (brown clusters) surrounded by liver (light brown) and immune cells (pink). Researchers seek to discover how the surrounding matrix (white/blue) facilitates or limits the interactions between them.
SHAPE SHIFTERS: CANCER CELLS IN MOTION
Claudia Schafer, Frank Gertler
Koch Institute at MIT

These metastatic lung cancer cells are showing their true nature as they wander around the dish. Images taken ten minutes apart over the course of 16 hours are stacked atop each other to create a composite image. Researchers in the Gertler Lab are studying how different levels of proteins expressed by the cells affect their shape and motion.

Take a look—can you trace the pathways? Are the cells moving slowly or quickly? Do they change shape or stay round? How do they compare to each other?

PUSHING BOUNDARIES: OVARIAN CANCER HIDES IN PLAIN SIGHT
Erik C. Dreaden, Yi Wen Kwong, Michael Yaffe, Paula T. Hammond
Koch Institute at MIT

Persistence is key. Here, an ovarian tumor clings to the abdominal wall, slowly breaking through the tissue boundaries that block its metastatic spread. The tissues here were stained with a molecule that binds to cells that are rapidly growing and multiplying (white). Just as tenacious as these proliferating cells, however, are the researchers who study it. The Hammond and Yaffe Labs are working together to better understand and exploit the genetic weaknesses of these tumors in various disease models, and soon will test their response to experimental treatments, unlocking new avenues for investigation and intervention.

BODY OF KNOWLEDGE: SELF-ORGANIZING BRAIN CELLS
Collin Edington, Iris Lee, Linda Griffith
MIT Department of Biological Engineering and Koch Institute at MIT

Imagine a uniform field of neural stem cells sitting on gel-like matrix. Slowly, they begin to differentiate, grouping and clustering together until they have self-assembled into a mini-organ—a brain!

The neurons (green) and astrocytes (red) seen here are part of the Griffith Lab’s “Human on a Chip” project. Many different “mini-organs” are linked together in a bioreactor platform, allowing researchers to study the interactions of multiple organs and the crosstalk between them in an in vitro setting, and to accelerate the development of novel disease treatments.

HASHTAG NO FILTER: VISUALIZING BREAST CANCER CONVERSATIONS
Eric Clarke, Richard Arnett, Jane Burns
Royal College of Surgeons in Ireland, Wellcome Images

Eight weeks. 92,915 tweets. One hashtag. This image literally visualizes conversations around breast cancer, and the network of connected cancer patients and their loved ones, patient advocates, oncologists and other health care professionals, as well as cancer researchers. #breastcancer joins these diverse stakeholders together in one conversation and puts everyone on the same page, erasing societal boundaries to share knowledge and support in real time.

This image appears in the Koch Institute Public Galleries as part of a partnership between the Koch Institute and Wellcome Images.
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500 Main Street, Cambridge, MA

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web ki-galleries.mit.edu
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HOURS
8am–6pm, Mon–Thu
8am–4pm, Fri
Admission is free

OTHER VISITOR ATTRACTIONS AT MIT
MIT Museum
MIT List Visual Arts Center and public art tour
Maihaugan Gallery, MIT Libraries
MIT Media Lab
Ray and Maria Stata Center
Corridor Lab in Strobe Alley, MIT Edgerton Center

cover art
Microfluidics for the Masses
Selim Olcum, Nick Calistri, Scott Manalis [Manalis Lab, Koch Institute at MIT]