Report to the President year ended June 30, 2025, McGovern Institute for Brain Research

The McGovern Institute was established in 2000 based on a gift from Lore Harp McGovern and the late Patrick J. McGovern. The McGovern Institute is committed to meeting two great challenges of modern science: understanding how the brain works and discovering new ways to prevent or treat brain disorders.

Faculty

For the period July 1, 2024 – June 30, 2025, we had 15 "core" faculty and 7 associate members.

Faculty Search

The McGovern Institute conducted a faculty search this year for a computational neuroscientist hire. The new assistant professor in the department of brain and cognitive sciences and McGovern Institute Investigator will join us in January 2026.

Resource Development

Fundraising from individuals and private foundations remains a priority at the McGovern Institute. McGovern Institute staff hosted in-person donor cultivation events, continuing to raise significant gifts and pledges to fund our research.

MIBR Community and Culture

The McGovern Institute continues to share the support of a Community and Culture officer, funding a research scholars program giving students research experience to prepare for graduate schools. MIBR and all our centers, including the Poitras Center and Yang Tan Centers offer fellowships at the graduate and postgraduate level.

Outreach

The McGovern Institute continues to focus on outreach to attract the next generation of neuroscience researchers. We have developed digital content for both in-person and external outreach.

Our volunteer outreach program to communicate brain science to the public includes graduate students, postdoctoral associates and fellows, post-baccalaureates and technicians. For the third year in a row we partnered with the MIT museum for a successful "Decoding the Brain" event held at the MIT Museum as part of the Cambridge Science Festival. The half-day event was organized by Jill Crittenden and included talks and interactive demonstrations from sixteen McGovern neuroscientist graduate students, postdocs or technicians. The museum reported that this was one of the most highly subscribed events with 138 attendees. The museum also worked

with us to recruit neuroscientists to participate in one of their "After Dark" events (visual perception theme) in which the public engaged in hands-on activities with scientists.

In December 2024, Jill Crittenden recruited 12 neuroscientists in the McGovern Institute and building 46 to participate in a STEM event that involved all the 7th grade students in Cambridge Public School (~415 scholars). The event was hosted by the computer science dean at Cambridge Public Schools and was held at the MIT Museum. MIT neuroscientists described how they use computer science and big data sets in their research and engaged middle schoolers in conversations about taking STEM classes in high school.

Jill Crittenden partnered again this year with the City of Cambridge youth summer employment program to co-mentor high school students who are 1) highly motivated to develop STEM skills that would make them a candidate for admission to top-tier colleges and 2) in need of mentorship, e.g. no close ties to high-level STEM careers and limited financial resources in their family. The city paid an hourly wage for six weeks to two students to conduct full-time research with a scientist in the McGovern Institute. One of the students has been mentored for three full years, and the city supported a second student. A postdoc in a McGovern lab served as a co-mentor on a computational project.

In summer 2024, the McGovern Institute hosted 12-14 year old summer campers from the Aspire Summer camp for people with autism to tour the MIT campus and the McGovern Institute, which included experiencing a mock scan in the MRI brain scanner in the Martinos Center, using microscopes to view transgenic mouse brains, and trying out virtual reality settings that are used to test how people use vision to plan their motor actions.

In July 2024 the McGovern Institute's scientific advisor mentored a rising high school freshman as part of the Cambridge Mayor's Youth Program, a city program designed to provide early work experiences for underprivileged youth. Goals for the student included computational neuroscience research with Fernanda De La Torre Romo in the McDermott lab, journal clubs and lectures for summer interns in the Gabrieli lab, manuscript reviews and seminar attendance with scientific advisor Jill Crittenden and career development training through the city.

Tours are ongoing for veterans and active-duty military who are part of the Warrior-Scholar summer program at MIT. Omar Rutledge, a US Army veteran who is now a graduate student in the Gabrieli lab has hosted these for several years now.

Career Development

The annual chalk-talk mentorship series for postdocs and research scientists in the McGovern and building 46 continued for the year. It included events such as a panel discussion and Q&A with four postdocs who obtained tenure-track faculty positions over the previous year.

We used internal quality-of-life grant funding from the School of Science to match neuroscientists in our building who have similar scientific interests or complementary scientific/technical expertise or needs but are in different labs. Over seventy people participated and were matched in

groups of 5-6 using a Neuromatch AI program. The program hosted three lunches for groups to meet and collaborate.

MIT hired a Program Director for Postdoctoral Career and Professional Development with whom our Scientific Advisor partnered with on programming such as a Q&A panel with MIT alumni.

Yang Post-Baccalaureate Program

Continuing with our efforts to build a more robust pipeline of people in brain science and neuroengineering, our Yang Post-Baccalaureate Program gives recent college graduates from economically disadvantaged backgrounds an opportunity to earn up to two years of research experience and mentorship from McGovern Institute faculty and postdoctoral scholars. The goal of the program is to give the individuals the research experience they need to successfully apply for graduate school in neuroscience, possibly in MIT's BCS or Biological Engineering Programs.

Addiction initiative

Our addiction initiative is ongoing with support from McGovern Institute co-founder Lore Harp McGovern donors and continues to be led by Professor Fan Wang. Our scientists and engineers are collaborating to develop a fundamental understanding of the biological underpinnings of addiction and create new scientifically driven strategies to treat this complex disorder.

Centers

The Yang Tan Collective at MIT comprises six distinct units committed to improving human health and wellbeing at a global scale. At each center, interdisciplinary teams of scientists and engineers join to address some of the greatest biomedical challenges of our time. Five centers within the Collective are administered by the McGovern Institute for Brain Research while a sixth center, the K. Lisa Yang Global Research and Engineering (GEAR) Center is led by Principal Investigator Amos G Winter and is housed in the MIT School of Engineering.

K. Lisa Yang and Hock E. Tan Center for Molecular Therapeutics in Neuroscience

The center aims to change how we treat brain disorders by developing innovative molecular tools that precisely target dysfunctional genetic, molecular, and circuit pathways. Our focus is on: genetic engineering using CRISPR tools, delivery of genetic and molecular cargo across the blood-brain barrier, and the translation of basic research into the clinical setting. The center serves as a hub for researchers with backgrounds ranging from biological engineering and genetics to computer science and medicine.

Hock E. Tan and K. Lisa Yang Center for Autism Research

The center supports and catalyzes new research approaches and potential treatments for individuals affected by Autism, emphasizing novel projects difficult to fund through traditional grants. Concentrated research efforts on new models, therapeutic approaches, and a push toward understanding changes in the human brain, the center aims to better detect, treat, and potentially prevent the most severe forms of ASD.

K. Lisa Yang Integrative Computational Neuroscience (ICoN) Center

The center pioneers computational models of brain function that unify multiple levels of biological data, from molecules to circuits to behavior.

K. Lisa Yang Bionics Center

The center develops and implements new technologies for prosthetic limbs, including artificial sensory stimulation and optogenetic control. Professors Hugh Herr and Edward Boyden head the center. Hugh is a double-amputee and widely recognized for his innovative research in prosthetics.

K. Lisa Yang Brain-Body Center

Led by Professor Polina Anikeeva, the center creates novel tools to explore the multidirectional, multilevel interplay between the brain and other body organ systems with the goal of advancing therapies and predictive diagnostics to achieve healthy minds in healthy bodies.

Poitras Center for Psychiatric Disorders Research

The Poitras Center has enabled numerous discoveries and technical advances in the field of psychiatric research, many of which have been published in top scientific journals as Nature, Science and Cell. Poitras Center support has made possible national and international collaborations with renowned researchers and clinicians and provided a vital source of support for the next generation of neuroscientists and biological engineers.

McGovern Institute Board

The McGovern board meets quarterly. Membership of the board consisted of: Lore McGovern, Elizabeth McGovern, Nergis Mavalvala, Robert Langer, James Poitras; Joshua Sanes, Morgan Sheng, Allyson Tevrizian and Lisa Yang.

The McGovern Institute Leadership Board

The board, which meets once per year, participates in programming at the McGovern Institute and interacts with the director and faculty members throughout the year, providing critical funding and strategic advice to the McGovern Institute.

The McGovern Institute Scientific Advisory Board

The board, which meets every two years, advises the director and faculty members throughout the year, providing scientific assessment of programs and strategic advice to the McGovern Institute.

Major events

McGovern Institute turns 25

Our 25th anniversary year included a year of special programming. In addition, we created a special newsletter, created and distributed neuroscience-related postcards and posters to acknowledge McGovern at 25, announced 25th anniversary fellows who received special recognition and funding, along with branding everything we did in 2025 in celebration of this anniversary.

Phillip A. Sharp Lecture in Neural Circuits

Mala Murthy, from Princeton University gave the lecture "Circuit Mechanisms for Dynamic Social Interactions" on Thursday, May 22, 2025, followed by a public reception and private dinner.

Scolnick Prize in Neuroscience

Leslie Vosshall was the 2025 Edward M. Scolnick Prize winner. Her talk "Mosquitoes: neurobiology of the world's most dangerous animal", was given on Friday May 9, 2025, at the McGovern Institute followed by a reception and dinner. Leslie is the Robin Chemers Neustein Professor and head of the Laboratory of Neurogenetics and Behavior at The Rockefeller University, as well as Vice President and Chief Scientific Officer of the Howard Hughes Medical Institute. A molecular neurobiologist, Vosshall studies how behaviors emerge from the integration of sensory input with internal physiological states, with a specific focus on host-seeking and blood-feeding by mosquitoes that spread dangerous viruses. She is a vocal proponent of published pre-prints and open science, as well as a strong supporter of inclusion in STEM. Her ongoing initiatives at HHMI aim to enhance the culture and climate in HHMI laboratories by fostering inclusive mentoring.

Building 46 Colloquium Series

This series, supported by The McGovern Institute, Picower Institute, and Department of Brain and Cognitive Sciences, hosted speakers to present their research during the 2024/25 year.

McGovern Institute Symposium (25th Anniversary Spring Symposium)

Each spring the McGovern Institute organizes a scientific symposium, held in Cambridge at MIT In celebration of the McGovern Institute's 25th anniversary, this symposium featured alumni of the McGovern Institute who gave talks about their research and participated in a panel discussion. The schedule for this event is here. There were remarks from McGovern Institute co-founder Lore McGovern and inaugural director Phillip Sharp, along with a talk looking to the future by McGovern Institute Director Robert Desimone. Institute Professor Robert Langer gave a talk titled "An engineering road not taken: from research to clinical translation". Nergis Mavalvala, Dean, School of Science gave closing remarks. Following the event there was a public reception.

Annual Retreat

The McGovern Institute continues to hold an annual retreat, with every other year being a combined retreat with the Picower Institute and the department of brain and cognitive sciences. This year's building-wide retreat was held in June in Newport, Rhode Island. We had a large group of over 300 people with an interactive format that included talks by faculty, networking opportunities, career sessions, a poster session and time set aside for socializing.

Core Facilities

The McGovern Institute operates several core laboratories, which serve the local neuroscience community including members of the McGovern Institute. These include:

The Martinos Imaging Center at MIT

The center provides access to neuroimaging technologies, including two 3T MRI scanners for human brain imaging, a 9.4T MRI scanner for small animal imaging, a magnetoencephalography scanner, and an electroencephalography system. There is also a coil fabrication lab and a mock MRI scanner to help subjects (especially children) adapt to the scanning environment.

The two-photon microscopy core

This core features a sophisticated two-photon system with four lasers to support 2-color imaging and uncaging. The system includes two workstations, configured for slice physiology and whole animal work and was upgraded to include an electrophysiology system. Also included is a light-sheet microscope to image large anatomical sections that have been made transparent, enabling tracing of neural pathways. The core is managed by McGovern Institute investigator Mark Harnett and is provided free of charge to those in the neuroscience building.

The OpenMind computing cluster

Established in 2014, provides the MIT brain research community with access to state-of-art computing resources. The cluster, housed at the Massachusetts Green High Performance Computing Center (MGHPCC) in Holyoke, MA, has a 10G link to the MIT campus. The OpenMind cluster serves the entire neuroscience community and beginning in July 2023 began a strategic collaboration, and the signing of a formal memorandum of understanding, between the OpenMind project and the Office of Research Computing and Data, (ORCD). OpenMind will transfer the significant OpenMind high performance computing (HPC) assets and resources to ORCD management, which includes over 3,500 CPU, more than 3 petabytes of storage, and over 350 GPGPU devices. These HPC systems are now supported by ORCD systems and support staff, which will additionally allow for the transfer of existing expert research software engineering and facilitation staff to join ORCD. This will further extend the capabilities of the new MIT wide research computing consulting team in ORCD to further partner with scientists across the institute.

Awards and Honors

Faculty

Polina Anikeeva | Blavatnik Award Finalist

Evelina Fedorenko | Troland Award, National Academy of Sciences

John Gabrieli | World Literacy Award, Academic Research Recognition | World Literacy Foundation

Ann Graybiel | 2024 Citation Laureate in Physiology or Medicine

Hugh Herr | Accessibility 100 List, Forbes

Tomaso Poggio | LericiPea Award

Tomaso Poggio | Frontiers of Science Award, ICBS

Fan Wang | National Academy of Medicine

Feng Zhang | National Medal of Technology and Innovation, Office of the President of the United States

Feng Zhang | Associate Member, EMBO | Honorary Doctor of Science, Duke University

Postdocs, Graduate Students and MIT Staff

Ani Ayvazian-Hancock (DiCarlo lab) Building 46 Staff Excellence Award, Go-To Person | Brain and Cognitive Sciences, MIT

Caludia Cea (Anikeeva Lab) | 35 Innovators Under 35, MIT Technology Review

Alexandra Decker (Gabrieli lab) Building 46 Community Impact Award | Brain and Cognitive Sciences, MIT
Sarah Frank (McGovern HQ) | Building 46 Staff Excellence Award, Morale Booster | Brain and Cognitive Sciences, MIT

Samantha Gutierrez-Arango (Herr lab) | 2024 MIT RISE Unsung Hero Award

Meaghan Jalbert (McGovern HQ) | Golden Gatekeeper Award | International Scholars Office, MIT

Cui Li (Feng lab) | Building 46 Community Impact Award | Brain and Cognitive Sciences, MIT
David Oluigbo (Fedorenko UROP) | Rhodes Scholar, University of Oxford

Sol Markman (Jazayeri lab) | Walle Nauta Award for Excellence in Graduate Teaching | Brain and Cognitive Sciences, MIT

Christopher Shay (DiCarlo lab) | Building 46 Staff Excellence Award, Go-To Person | Brain and Cognitive Sciences, MIT

Hokyung Sung (Jazayeri lab) | Walle Nauta Award for Excellence in Graduate Teaching | Brain and Cognitive Sciences, MIT

Lisa Yang | Time 100 Philanthropy, TIME

Summary of Research Advances

July 15, 2024

Study reveals how an anesthesia drug induces unconsciousness | Neuron

Exactly how anesthesia drugs cause the brain to lose consciousness has been a longstanding question, but Ila Fiete and Earl Miller (Picower) have now answered that question for one commonly used anesthesia drug. Using a novel technique for analyzing neuron activity, the researchers discovered that the drug propofol induces unconsciousness by disrupting the brain's normal balance between stability and excitability. The drug causes brain activity to become increasingly unstable, until the brain loses consciousness.

July 23, 2024

Mehrdad Jazayeri selected as an HHMI investigator

The Howard Hughes Medical Institute (HHMI) has named Mehrdad Jazayeri as one of 26 new HHMI investigators—a group of visionary scientists who HHMI will support with more than $300 million over the next seven years.

July 24, 2024

Three MIT professors named 2024 Vannevar Bush Faculty Fellows

The U.S. Department of Defense (DoD) has announced three MIT professors, including

Mehrdad Jazayeri, among the members of the 2024 class of the Vannevar Bush Faculty Fellowship (VBFF). The fellowship is the DoD's flagship single-investigator award for research, inviting the nation's most talented researchers to pursue ambitious ideas that defy conventional boundaries.

August 26, 2024

Scientists find neurons that process language on different timescales | Nature Human Behavior

Using functional magnetic resonance imaging (fMRI), neuroscientists have identified several regions of the brain that are responsible for processing language. However, discovering the specific functions of neurons in those regions has proven difficult because fMRI, which measures changes in blood flow, doesn't have high enough resolution to reveal what small populations of neurons are doing. Now, using a more precise technique that involves recording electrical activity directly from the brain, Ev Fedorenko has identified different clusters of neurons that appear to process different amounts of linguistic context. These "temporal windows" range from just one word up to about six words.

September 5, 2024

Harnessing the power of placebo for pain relief | Current Biology

To maximize the impact of the placebo effect and design reliable therapeutic strategies, researchers need a better understanding of how it works. Now, Fan Wang has developed a new animal model to investigate the neural circuits that underlie placebos' ability to elicit pain relief. Wang and her team report that they have elicited strong placebo pain relief in mice by activating pain-suppressing neurons in the brain while the mice are in a specific environment—thereby teaching the animals that they feel better when they are in that context. Following their training, placing the mice in that environment alone is enough to suppress pain. The team's experiments show that this context-dependent placebo effect relieves both acute and chronic pain.

September 5, 2024

Finding some stability in adaptable brains | Cell Reports

Mark Harnett has shown how individual neurons can contribute to the brain's ability to balance stability and flexibility. By studying the synapses through which pyramidal neurons in the brain's sensory cortex communicate, they have learned how the cells preserve their understanding of some of the world's most fundamental features, while also maintaining the flexibility they need to adapt to a changing world.

September 12, 2024

Polina Anikeeva named 2024 Blavatnik Award finalist

Polina Anikeeva is among five finalists in the category of physical sciences and engineering. The Blavatnik National Awards for Young Scientists is the largest unrestricted scientific prize offered to America's most promising, faculty-level scientific researchers under 42.

October 11, 2024

Tiny magnetic discs offer remove brain stimulation without transgenes | Nature Nanotechnology

Novel magnetic nanodiscs developed by Polina Anikeeva could provide a much less invasive way of stimulating parts of the brain, paving the way for stimulation therapies without implants or genetic modification. Her team envisions that the tiny discs, which are about 250 nanometers across (about 1/500 the width of a human hair), would be injected directly into the desired location in the brain. From there, they could be activated at any time simply by applying a magnetic field outside the body. The new particles could quickly find applications in biomedical research, and eventually, after sufficient testing, might be applied to clinical uses.

October 11, 2024

A new method makes high-resolution imaging more accessible | Nature Methods

A classical way to image nanoscale structures in cells is with high-powered, expensive super-resolution microscopes. As an alternative, Ed Boyden has developed a way to expand tissue before imaging it — called Expansion Microscopy, the technique allows them to achieve nanoscale resolution with a conventional light microscope. In the newest version of this technique, the researchers have made it possible to expand tissue 20-fold in a single step. This simple, inexpensive method could pave the way for nearly any biology lab to perform nanoscale imaging.

October 15, 2024

Model reveals why debunking election misinformation often doesn't work | PNAS Nexus

When an election result is disputed, people who are skeptical about the outcome may be swayed by figures of authority who come down on one side or the other. However, these "debunking" efforts don't always have the desired effect, and in some cases, they can lead people to cling more tightly to their original position. Together with political scientists at MIT and UC Berkeley, Rebecca Saxe has created a computational model that analyzes the factors that help to determine whether debunking efforts will persuade people to change their beliefs about the legitimacy of an election. Their findings suggest that while debunking fails much of the time, it can be successful under the right conditions.

October 23, 2024

Brain pathways that control dopamine release may influence motor control | Current Biology

Within the human brain, movement is coordinated by a brain region called the striatum, which sends instructions to motor neurons in the brain. Those instructions are conveyed by two pathways, one that initiates movement ("go") and one that suppresses it ("no-go"). Ann Graybiel has discovered an additional two pathways that arise in the striatum and appear to modulate the effects of the go and no-go pathways. These newly discovered pathways connect to dopamine-producing neurons in the brain — one stimulates dopamine release and the other inhibits it. They may be especially involved in influencing decisions that have a strong emotional component, the researchers say.

October 28, 2024

Brains, fashion, alien life, and more: Highlights from the Cambridge Science Festival | MIT Museum

The McGovern Institute organized a "Decoding the Brain" event at the MIT Museum featuring three talks and six interactive demos with McGovern postdocs, grad students, and research staff.

October 30, 2024

Adults' brain activity appears unchanged after a year of medical use of cannabis | JAMA Open Network

In a study of adults who use cannabis because they are seeking relief from pain, depression, anxiety, or insomnia, Satra Ghosh and colleagues found no changes in brain activity after one year of self-directed use. The study is among the first to investigate how the real-world ways people use cannabis to treat medical symptoms might impact the brain in lasting ways.

November 1, 2024

A cell protector collaborates with a killer | Science Advances

From early development to old age, cell death is a part of life. Without enough of a critical type of cell death known as apoptosis, animals wind up with too many cells, which can set the stage for cancer or autoimmune disease. But careful control is essential, because when apoptosis eliminates the wrong cells, the effects can be just as dire, helping to drive many kinds of neurodegenerative disease. By studying the microscopic roundworm Caenorhabditis elegans—which was honored with its fourth Nobel Prize last month—the Horvitz lab has begun to unravel a longstanding mystery about the factors that control apoptosis: how a protein capable of preventing programmed cell death can also promote it. Their study sheds light on the process of cell death in both health and disease.

November 6, 2024

McGovern scientists create a comprehensive map of the cerebral cortex | Neuron

By analyzing brain scans taken as people watched movie clips, the Desimone lab has created the most comprehensive map yet of the functions of the brain's cerebral cortex.

Using fMRI data, his team identified 24 networks with different functions, which include processing language, social interactions, visual features, and other types of sensory input. Many of these networks have been seen before but haven't been precisely characterized using naturalistic conditions.

November 15, 2024

Illuminating the architecture of the mind | McGovern Institute, Winter 2025 BrainScan

The winter 2025 issue of BrainScan is dedicated entirely to Nancy Kanwisher's transformative role as a scientist, teach, and mentor at the McGovern Institute.

November 18, 2024

Revisiting reinforcement learning | Nature Communications

Dopamine is a powerful signal in the brain, influencing our moods, motivations, movements, and more. The neurotransmitter is crucial for reward-based learning, a function that may be disrupted

in a number of psychiatric conditions, from mood disorders to addiction. Now, researchers led by Ann Graybiel have found surprising patterns of dopamine signaling that suggest neuroscientists may need to refine their model of how reinforcement learning occurs in the brain. The researchers found that the timing of dopamine release varied in different parts of the striatum. But nowhere did Graybiel's team find a transition in dopamine release timing from the time of the reward to the time to the cue—the key transition predicted by the standard model of reinforcement learning model.

December 6, 2024

Personal interests can influence how children's brains respond to language | Imaging Neuroscience

A new study from John Gabrieli's lab shows how interests can modulate language processing in children's brains and paves the way for personalized brain research. Traditional studies give subjects identical stimuli to avoid confounding the results, but the new study tailored stimuli to each child's interest, eliciting stronger—and more consistent—activity patterns in the brain's language regions across individuals. This work unveils a new paradigm that challenges current methods and shows how personalization can be a powerful strategy in neuroscience.

December 13, 2025

For healthy hearing, timing matters | Nature Communications

Auditory neurons can fire hundreds of spikes per second, and time their spikes with exquisite precision to match the oscillations of incoming soundwaves. With powerful new models of human hearing, Josh McDermott has determined that this precise timing is vital for some of the most important ways we make sense of auditory information, including recognizing voices and localizing sounds. The findings show how machine learning can help neuroscientists understand how the brain uses auditory information in the real world.

December 18, 2024

How the brain prevents us from falling | Nature Communications

Humans adapt their locomotion seamlessly in response to changes in the body or the environment. It is unclear how such adaptation improves performance measures like energy consumption or symmetry while avoiding falling. Nidhi Seethapathi models locomotor adaptation as interactions between a stabilizing controller that reacts quickly to perturbations and a reinforcement learner that gradually improves the controller's performance through local exploration and memory. Such a model-based understanding of adaptation can guide rehabilitation and wearable robot control.

January 10, 2025

Scientists engineer CRISPR enzymes that evade the immune system | Nature Communications

The core components of CRISPR-based genome-editing therapies are bacterial proteins called nucleases that can stimulate unwanted immune responses in people, increasing the chances of side effects and making these therapies potentially less effective. Feng Zhang's team has now engineered two CRISPR nucleases, Cas9 and Cas12, to mask them from the immune system. The team identified protein sequences on each nuclease that trigger the immune system and used computational modeling to design new versions that evade immune recognition. The findings could help pave the way for safer, more efficient gene therapies.

January 15, 2025

How one circuit encodes memories of both places and events | Nature

Nearly 50 years ago, neuroscientists discovered cells within the brain's hippocampus that store memories of specific locations. These cells also play an important role in storing memories of events, known as episodic memories. While the mechanism of how place cells encode spatial memory has been well-characterized, it has remained a puzzle how they encode episodic memories. A new model developed by Ila Fiete explains how those place cells can be recruited to form episodic memories, even when there's no spatial component. According to this model, place cells, along with grid cells found in the entorhinal cortex, act as a scaffold that can be used to anchor memories as a linked series. The model accurately replicates several features of biological memory systems, including the large storage capacity, gradual degradation of older memories, and the ability of people who compete in memory competitions to store enormous amounts of information in "memory palaces."

February 18, 2025

Seeing more in expansion microscopy | Nature Communications

With a pair of new methods, the Boyden lab has expanded the capabilities of expansion microscopy—a high-resolution imaging technique the group introduced in 2015—so researchers everywhere can see more when they look at cells and tissues under a light microscope. With new ways of staining their samples and processing images, users of expansion microscopy can now see vivid outlines of the shapes of cells in their images and pinpoint the locations of many different proteins inside a single tissue sample with resolution that far exceeds that of conventional light microscopy. These advances, both reported in the journal Nature Communications, enable new ways of tracing the slender projections of neurons and visualizing spatial relationships between molecules that contribute to health and disease.

February 19, 2025

How nature organizes itself, from brain cells to ecosystems | Nature

Ila Fiete reports that a mathematical model called peak selection can explain how modules

emerge without strict genetic instructions. Her team's findings, which apply to brain systems and ecosystems, help explain how modularity occurs across nature, no matter the scale.

February 27, 2025

An ancient RNA-guided system could simplify delivery of gene editing therapies | Science

A vast search of natural diversity has led Feng Zhang to uncover ancient systems with potential to expand the genome editing toolbox. These systems, which the researchers call TIGR (Tandem Interspaced Guide RNA) systems, use RNA to guide them to specific sites on DNA. TIGR systems can be reprogrammed to target any DNA sequence of interest, and they have distinct functional modules that can act on the targeted DNA. In addition to its modularity, TIGR is very compact compared to other RNA-guided systems, like CRISPR, which is a major advantage for delivering it in a therapeutic context.

March 3, 2025

Ten years of bigger samples, better views

Ten years after its debut, expansion microscopy is empowering scientists to see life's smallest components—and it keeps getting better.

March 3, 2025

Leslie Vosshall awarded the 2025 Scolnick Prize in Neuroscience

The 2025 Edward M. Scolnick Prize in Neuroscience will be awarded to Leslie Vosshall, the Robin Chemers Neustein Professor at The Rockefeller University and Vice President and Chief Scientific Officer of the Howard Hughes Medical Institute. Vosshall is being recognized for her discovery of the neural mechanisms underlying mosquito host-seeking behavior. The Scolnick Prize is awarded annually by the McGovern Institute for outstanding achievements in neuroscience.

March 18, 2025

To the brain, Esperanto and Klingon appear the same as English or Mandarin | PNAS

Within the human brain, a network of regions has evolved to process language. These regions are consistently activated whenever people listen to their native language or any language in which they are proficient. A new study by Ev Fedorenko finds that this network also responds to languages that are completely invented, such as Esperanto, which was created in the late 1800s as a way to promote international communication, and even to languages made up for television shows such as "Star Trek" and "Game of Thrones." The findings help to define some of the key properties of language, the researchers say, and suggest that it's not necessary for languages to have naturally evolved over a long period of time or to have a large number of speakers.

April 2, 2025

Looking under the hood at the brain's language system

As a young girl growing up in the former Soviet Union, Evelina Fedorenko PhD '07 studied several languages, including English, as her mother hoped that it would give her the chance to eventually move abroad for better opportunities. Her language studies not only helped her establish a new life in the United States as an adult but also led to a lifelong interest in linguistics and how the brain processes language. Now a McGovern investigator and an associate professor of brain and cognitive sciences at MIT, Fedorenko studies the brain's language-processing regions: how they arise, whether they are shared with other mental functions, and how each region contributes to language comprehension and production. Fedorenko's early work helped to identify the precise locations of the brain's language-processing regions, and she has been building on that work to generate insight into how different neuronal populations in those regions implement linguistic computations.

April 11, 2025

Twenty-five years after its founding, the McGovern Institute is shaping brain science and improving human lives at a global scale

On April 11, 2025, the McGovern Institute celebrated its 25th anniversary with a half day symposium featuring presentations by MIT Institute Professor Robert Langer, alumni speakers from various McGovern labs, and Desimone, who is in his twentieth year as director of the institute.

April 15, 2025

A visual pathway in the brain may do more than recognize objects | ICLR 2025

When visual information enters the brain, it travels through two pathways that process different aspects of the input. For decades, scientists have hypothesized that one of these pathways, the ventral visual stream, is responsible for recognizing objects, and that it might have been optimized by evolution to do just that. Consistent with this, in the past decade, MIT scientists have found that when computational models of the anatomy of the ventral stream are optimized to solve the task of object recognition, they are remarkably good predictors of the neural activities in the ventral stream. However, in a new study out of Jim DiCarlo's lab, researchers have shown that when they train these types of models on spatial tasks instead, the resulting models are also quite good predictors of the ventral stream's neural activities. This suggests that the ventral stream may not be exclusively optimized for object recognition.

April 28, 2025

Daily mindfulness practice reduces anxiety for autistic adults | Mindfulness

Just ten to 15 minutes of mindfulness practice a day led to reduced stress and anxiety for autistic

adults who participated in a study led by John Gabrieli. Participants in the study used a free smartphone app to guide their practice, giving them the flexibility to practice when and where they chose. After six weeks of practicing mindfulness, adults with autism reported lasting improvements in their well-being.

May 8, 2025

Rationale engineering generates a compact new tool for gene therapy | Nat Biotech

Feng Zhang's team reengineered a compact RNA-guided enzyme they found in bacteria into an efficient, programmable editor of human DNA. The protein they created, called NovaIscB, can be adapted to make precise changes to the genetic code, modulate the activity of specific genes, or carry out other editing tasks. Because its small size simplifies delivery to cells, NovaIscB's developers say it is a promising candidate for developing gene therapies to treat or prevent disease.

June 6, 2025

How the brain distinguishes between ambiguous hypotheses | Nature Neuroscience

When navigating a place that we're only somewhat familiar with, we often rely on unique landmarks to help make our way. However, if we're looking for an office in a brick building, and there are many brick buildings along our route, we might use a rule like looking for the second building on a street, rather than relying on distinguishing the building itself. Until that ambiguity is resolved, we must hold in mind that there are multiple possibilities (or hypotheses) for where we are in relation to our destination. In a study of mice, Mark Harnett's team discovered that these hypotheses are explicitly represented in the brain by distinct neural activity patterns. This is the first time that neural activity patterns that encode simultaneous hypotheses have been seen in the brain. The researchers found that these representations, which were observed in the brain's retrosplenial cortex (RSC), not only encode hypotheses but also could be used by the animals to choose the correct way to go.

June 11, 2025

How the brain solves complicated problems | Nature Human Behavior

The human brain is very good at solving complicated problems. One reason for that is that humans can break problems apart into manageable subtasks that are easy to solve one at a time. While there is a great deal of behavioral evidence demonstrating humans' skill at these complicated tasks, it has been difficult to devise experimental scenarios that allow precise characterization of the computational strategies we use to solve problems. In a new study, Mehrdad Jazayeri successfully modeled how people deploy different decision-making strategies to solve a complicated task — in this case, predicting how a ball will travel through a maze when the ball is hidden from view. The human brain cannot perform this task perfectly because it is impossible to track all the possible trajectories in parallel, but the researchers found that people

can perform reasonably well by flexibly adopting two strategies known as hierarchical reasoning and counterfactual reasoning.

Robert Desimone

Director, McGovern Institute for Brain Research

Doris and Don Berkey Professor of Brain and Cognitive Sciences