

MIT.nano

After more than six years of planning, design, and construction, the MIT.nano building was completed in June 2018, heralding the beginning of a new era of discovery and innovation at MIT.

MIT.nano is a comprehensive, state-of-the-art nanoscience and nanoengineering building adjacent to the Great Dome in the heart of the campus. The 214,000-square-foot facility will offer MIT researchers and innovators, as well as partners, access to broad and versatile toolsets for nanoscale advancements—from imaging to synthesis to fabrication and prototyping—entirely within the facility’s protective envelope. The most complex construction project in the history of the MIT campus, the building will offer deep and wide support for research, education, and community life at MIT.

Support for Research

The pristine laboratories of MIT.nano—including 40,000 square feet of high-performance clean rooms over two stories—will provide a remarkable space for researchers from across the campus. The building will include tools and spaces for prototyping and packaging, synthesis, imaging and microscopy, materials and thin film growth, numerical design, and immersive data visualization. It will be home to the most environmentally quiet space on campus, a basement level optimized to meet the most stringent nanoscale imaging requirements for low-vibration and low electromagnetic interference.

MIT.nano will support the work of existing intellectual centers on the MIT campus, such as the Microreproduction Laboratory, Materials Research Laboratory (MRL), Microsystems Technology Laboratories (MTL), the Research Laboratory of Electronics (RLE), Environmental Solutions Initiative (ESI), the MIT Energy Initiative (MITEI), and the Abdul Latif Jameel Water and Food Systems Laboratory (JWAFS). It will also facilitate emerging centers of excellence, such as the recently launched SENSE.nano, whose focus is on the development of nano-enabled sensors and sensing systems for persons and machines, environments, and ecosystems. Such centers of excellence coalesce the intellectual pursuits of a number of faculty members who can then offer a shared vision for the instruments and facilities that MIT.nano ought to have to support their work.

MIT.nano will be a shared toolset for the entire community. To ensure open access, faculty and staff oversee a multistep process for including new toolsets in the building. The process starts with a proposal by faculty members who typically would like to place a tool they are acquiring into MIT.nano. The staff of MIT.nano, together with the faculty, will decide if the needs of the tool can be met with the facilities already within MIT.nano, estimate the cost of installation of the new tool, and develop a financial model to confirm that operation of the tool can be sustained.

The proposed tool and the anticipated user base will then be presented to the MIT.nano director and the MIT.nano leadership team for approval. With that approval, construction documents for tool installation will be procured from a design firm, and, if the final costs are in the approved range, the installation will take place. Given the complexity of MIT.

nano facilities, this procedure provides for an orderly introduction of new instrument capabilities while ensuring that the operation of existing instruments is not compromised.

For example, one of the first tools to be installed in MIT.nano is a set of two cryo-electron microscopes (cryo-EMs), which allow structural biologists to analyze the nanoscale details of large, complex, and flexible biomolecules—such as folds in protein chains—at a resolution of better than 0.3 nanometer. Cryo-EM is a remarkable advancement for identification of biological nano-scale structures compared with the previous standard techniques of x-ray crystallography and nuclear magnetic resonance. The 2017 Nobel Prize in Chemistry was awarded to the researchers who advanced the cryo-EM technology.

Support for Education

The facility will enable a new era of nano-education at MIT, with hands-on learning spaces and advanced teaching tools integrated throughout the facility. In addition, the top floor is home to a suite of state-of-the-art chemistry teaching laboratories. Managed by the Department of Chemistry, the 20,000 square feet of learning space will support more than 1,700 undergraduate students—one third of the undergraduate population—who enroll in chemistry classes each year.

Welcoming and Inspiring the Campus Community

MIT.nano's design includes features aimed at fostering community connections and supporting campus and public events. A new courtyard on the southern side of the building sits parallel to the Infinite Corridor between the Bosworth buildings and MIT.nano. The path extending the length of the verdant space is named the Improbability Walk and dedicated to Institute Professor Emerita Mildred Dresselhaus—the first female Institute Professor. The widest part of the plaza to the west, planted with trees, will offer a unique place for public gatherings in the shadow of the Great Dome.

The first- and second-floor corridors overlooking this courtyard will be home to galleries that will showcase research and artistic efforts from the MIT community and others. In the two-story-high passageway on MIT.nano's west end, an installation by artist Olafur Eliasson will join MIT's public art collection.

The east- and west-side lobbies of MIT.nano extend into the adjoining buildings and provide public seating areas. Sprinkled throughout the building and brightened by skylights are a series of nooks and rooms with whiteboards for brainstorming, tables for collaborating, conference room spaces for meetings, and a large open classroom in the basement.

Launching MIT.nano

When MIT.nano is fully operational, it will support more than 2,000 researchers per year from every corner of the campus. Preparations for this future are under way already, including hiring administrative and technical staff and developing the systems, processes, and programs to support the facility's day-to-day operations. A faculty leadership team and a tool committee will continue to advise on the management and function of MIT.nano.

Technical staff will start moving the first tools inside the building in July 2018. The facility will require a few years to be completely outfitted, with plans to update 5–10% of the tools every year to keep its capabilities current. The first classes in the chemistry undergraduate teaching laboratories (on the top floor of MIT.nano) will be taught in September 2018. Planning is under way for an opening celebration on October 4, 2018.

MIT.nano Personnel and Partners

Director

Vladimir Bulović, Fariborz Maseeh (1990) Professor in Emerging Technology

MIT.nano Core Team

Mary Young—administrative officer

Dennis Grimard—managing director

Brian Anthony—outreach director

Tom Gearty—communications director

Tina Gilman—assistant director of programs

Nicholas Menounos—assistant director of infrastructure

Anna Osherov—user services (metrology.nano)

Jorg Scholvin—user services (fab.nano)

Annie Wang—special projects (50% research scientist)

Mara Karapetian—manager of media and design (50% shared with MTL)

Kristofor Payer—research specialist (50% shared with MTL)

Samantha Farrell—administrative assistant

Shereece Beckford—administrative assistant

Leadership Team

The MIT.nano leadership team meets once per month.

Brian Anthony—MIT.nano, Department of Mechanical Engineering (MechE)

Karl Berggren—NanoStructures Laboratory, Department of Electrical Engineering and Computer Science (EECS)

Vladimir Bulović—MIT.nano

Jesús del Alamo—MTL, EECS

Karen Gleason—Department of Chemical Engineering

Dennis Grimard—MIT.nano

Pablo Jarillo-Herrero—Department of Physics

Will Oliver—RLE, Department of Physics

Katharina Ribbick—Department of Biological Engineering

Thomas Schwartz—Department of Biology

Carl Thompson—MRL, Department of Material Science and Engineering (DMSE)

Tool Committee

Advice is solicited from subgroups of this committee.

Geoffrey Beach—MRL, DMSE

Vicky Diadiuk—MTL

Silvija Gradečak—DMSE

Kripa Varanasi—MechE

Farnaz Niroui—EECS

Anna Osherov—EECS, MRL

Founding Member Companies (as of July 2018)

DSM

Analog Devices, Inc.

IBM (membership agreement is being finalized)

Dow Chemical Company (membership agreement is being finalized)

Vladimir Bulović

MIT.nano Founding Director

Fariborz Maseeh (1990) Professor in Emerging Technology