

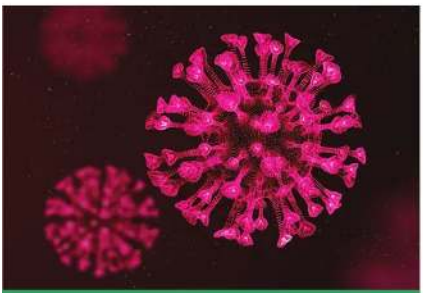
The Massachusetts Green High Performance Computing Center

Impact on Scientific Research, Computing and the Regional Knowledge-Based Economy

BOSTON UNIVERSITY · HARVARD UNIVERSITY · MIT · Northeastern University · UMASS · Yale

POWERING SCIENTIFIC ADVANCEMENTS

Computing and data storage resources at the MGHPCC support impactful research conducted by students and faculty from research-intensive institutions, and contribute to national and international collaborations. Examples include exploring the fundamental laws of physics with the Large Hadron Collider, advancing health care through better understanding of disease pathways, and seeding new science-based companies — all while bringing up a new generation of scientists and engineers.



CASE STUDY: YALE UNIVERSITY

Uncovering the Mysteries of Pandemic Outbreaks

Understanding the specific characteristics that allow certain viruses to effectively infect and spread among humans is crucial for preventing future pandemics. Researchers from the Yale School of Medicine studied the two closest known relatives of SARS-CoV-2 and identified a spike protein in the SARS-CoV-2 virus as a distinct, functional trait that enables it to effectively enter human cells. This critical feature is likely to help assess the potential of any virus to cause a pandemic in the future.

Funding: The Howard Hughes Medical Institute, and other sources



CASE STUDY: BOSTON UNIVERSITY

Climate and Public Health

The health risks of exposure to extreme hot weather are widely recognized. Early warning and response systems are central to protecting people on days of extreme heat. Boston University's Center for Climate and Health, in partnership with the Harvard T.H. Chan School of Public Health, has been assessing the effectiveness of heat alerts. Their findings are providing meteorologists, health and emergency management officials, and local policymakers with information to better protect public health and guide targeted research. This research is being funded by the National Institute of Environmental Health Sciences.

Funding: FAA, NIEHS

ENVIRONMENTAL LEADERSHIP

Going beyond energy efficiency and a low carbon footprint, the MGHPCC was the first research computing center ever to achieve LEED platinum, the highest level awarded by the Green Building Council. The MGHPCC consumes 100 percent carbon-free power, with the majority coming from local hydroelectric and solar generation. The center also employs advanced measures that place it among the most energy-efficient computing facilities in the world.

LEED
PLATINUM CERTIFIED

100%
CARBON-FREE POWER

DEMOCRATIZING ACCESS

Democratizing access to technology by making advanced computing resources available to small and mid-size institutions and companies, many from under-served communities, is a priority of the MGHPCC and its principal members. Resources include modern information delivery systems, simple user interfaces, community experts to develop materials that reduce the learning curve for end-users, and specialist mentors who work with students interested in becoming part of the next generation workforce.



CASE STUDY: MASSACHUSETTS INSTITUTE OF TECHNOLOGY

A New Source of Carbon-Free Energy

For more than half a century, scientists and engineers have been searching for a way to harness nuclear fusion for safe and economical delivery of electric power. This search has taken on greater importance as the effects of climate change become increasingly apparent. Massachusetts start-up Commonwealth Fusion Systems, in collaboration with Massachusetts Institute of Technology's Plasma Science and Fusion Center leverages the MGHPCC for its computationally intensive simulations as they seek to build the world's first net-energy fusion machine.

Funding: DOE



CASE STUDY: KEMPNER INSTITUTE AT HARVARD UNIVERSITY

Leveraging AI

Scientists still have a great deal to learn about the basis of intelligence and the fundamental mechanisms behind how humans, animals, and machines learn, compute, and reason. Researchers at the Kempner Institute for the Study of Natural and Artificial Intelligence at Harvard University are using artificial intelligence (AI) to analyze large sets of data, leading to insights about how brains function. As researchers learn more about how the brain works, they can engineer smarter and more powerful AI tools. By studying the foundations of intelligence in natural and artificial systems, findings lead to the development of groundbreaking tools and technologies that can be applied to everything from treating disease to emergency preparedness.

Funding: Chan Zuckerberg Initiative Foundation

FUELING THE REGIONAL INNOVATION ECOSYSTEM

The MGHPCC was envisioned as a catalyst for the regional innovation economy and job growth. Economic activity supported by the MGHPCC and its members includes educating students at the Bachelors, PhD and postdoctoral levels, attracting government and industry research grants, and spawning new products, start-ups and even entire industries.

MGHPCC BY THE NUMBERS

>20,000

Researchers Accessing MGHPCC Resources across a Wide Range of Academic Disciplines

1000s

of Individual Projects Leveraging MGHPCC Resources

>$3 BILLION

in Total Research Activity Conducted by the MGHPCC Founding Members

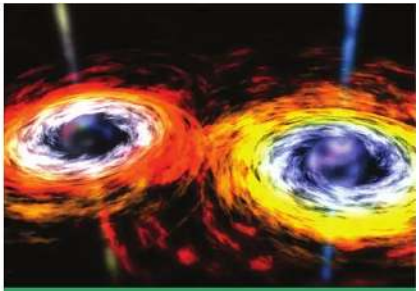


CASE STUDY: NORTHEASTERN UNIVERSITY

Breaking Barriers in Cancer Treatment

A long-standing cancer treatment challenge is the need for drug delivery systems that penetrate dense, fibrous tissue to reach cancer cells. Using computer simulations in combination with laboratory experiments, Northeastern University researchers have discovered techniques for softening drug delivery materials such as liposomes and nanoparticles so that they can squeeze through this tissue, increasing their uptake by cancer cells and tumors — an important advance in cancer treatment.

Funding: NIH, NEU (internal)



CASE STUDY: UNIVERSITY OF MASSACHUSETTS / UNIVERSITY OF RHODE ISLAND

Gravitational Waves

The discovery of gravitational waves — ripples in the fabric of space-time predicted by Albert Einstein and later confirmed by Nobel Prize-winning physicists — has yielded many insights into the workings of the universe. Researchers at UMass Dartmouth and the University of Rhode Island are using computationally intensive simulations to develop new models that use gravitational waves to see the universe in completely new ways.

Funding: NSF, NASA, private foundations (FQxI and others)

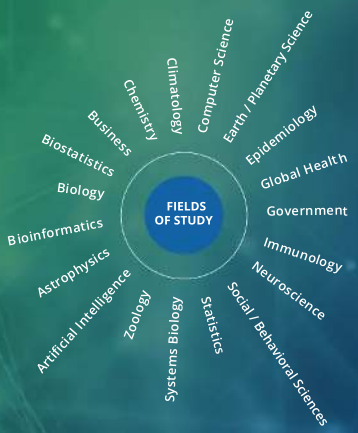
COMMUNITY ENGAGEMENT

The MGHPCC is firmly rooted in the city of Holyoke, Massachusetts. In addition to scholarships, internships, and support for educational and community organizations, the MGHPCC has invested more than $10 million in the city's infrastructure.



Across the regional innovation economy, research computing enables profound exploration and discovery. Progress in practically every field, from global health to climate change, depends on complex modeling, data analysis, and AI models that only large-scale research computing can provide.

As the largest aggregation of research computing power in the Northeast, the MGHPCC provides state-of-the-art computing for research scientists and encourages collaboration that facilitates discovery, innovation and economic growth. It represents a unique partnership of six research-intensive institutions: **Boston University**, **Harvard University**, **MIT**, **Northeastern University**, the **University of Massachusetts system** and **Yale University**, with support from the Commonwealth of Massachusetts and industry partners.



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