In celebration of MIT's 150th anniversary the Intelligence Initiative held the Brains, Minds and Machines symposium on May 3-5, 2011.

Letter from the Dean

Dear Friends,

This spring we are celebrating MIT's 150th anniversary, and it is a great time to think about the role of science in establishing MIT's leadership in the world. In its early years, MIT focused on providing the engineers needed by the firms that emerged from the industrial revolution. However, in the early 1900's, MIT's leadership appreciated that new industries would emerge from breakthroughs in science and that engineers would need a deeper understanding of basic science to be successful. Electing Karl Taylor Compton as President in 1930, MIT began to not only add rigorous science to its curriculum, but also hire faculty members who would create new scientific knowledge. Without this change in direction, MIT would not have been positioned to be a leading institution during World War II and the Cold War. However, the investment in science took a long time to pay off in recognition by the

continued on page 2
Letter from the Dean

continued from page 1

scientific community. For example, our faculty members and staff began to win Nobel Prizes only in the 1950’s (http://web.mit.edu/ir/pap/awards/nobel.html), whereas Columbia, Chicago, Harvard, and Berkeley were winning them in the 1930’s.

Today, each of the six departments in the School of Science is ranked at the top of its field. One can argue that MIT would not have been a leader in physical-science-based and mathematics-based engineering without great physical science and math departments, and it certainly would not be a powerhouse in life-science-based engineering without our spectacular leadership in the life sciences. I believe that the future of MIT’s leadership will also depend on maintaining strength in the sciences. However, with federal budgets for research being cut, we will need the help of our alumni and friends much more than ever before to sustain the sciences.

I hope you enjoy this issue of Science@MIT. We have an article by Scott Sheffield, illustrating how everyday problems can sometimes have relevance for forefront mathematics. We have an article by Tomaso Poggio on an ambitious initiative to make computers function more like the human mind. This is a challenge that MIT is uniquely positioned to attack, with its strengths in computational neuroscience, cognitive science, computer science, linguistics, man-machine interaction, economics, and business, all of which have a role to play. This is an initiative supported by the deans of all five of MIT’s schools because faculty members in all the schools are involved.

Also in this issue you will learn about a graduate student in math who mentors brilliant high school and undergraduate students, and we share news about the Dean’s Colloquium. I began this series to honor people who began in science but have outstanding accomplishments outside scientific research. I think it is very important for our young scientists to hear about such novel careers. This term we heard from Jim Simons and Charles Zhang, whose lectures can be seen on MIT World at http://mitworld.mit.edu/video/870 and http://mitworld.mit.edu/video/840, respectively.

In these pages we feature some of our donors. One of the highest priorities for the Institute is to provide fellowships for our graduate students. Each of our departments need these fellowships to compete for the very best graduate students, and we tell a story about an effort to create one in Earth, Atmospheric and Planetary Sciences. This is one example of how our alumni and friends can help us keep science strong at MIT. You can learn about other ways in this issue or by contacting my office. I urge you to think about helping us keep science great at MIT.

Marc Kastner
Dean, MIT School of Science

“In 1930, MIT began to not only add rigorous science to its curriculum, but also hire faculty members who would create new scientific knowledge.”

– Marc Kastner
The Intelligence Initiative (I²): It Is Time to Try Again

Tomaso Poggio
Eugene McDermott Professor in the Brain Sciences

Background
Back in the 1950’s and 1960’s, a remarkable intellectual activity grew around the new engineering and physics of electronics and information processing. If MIT was one of the main centers of this whirlwind of ideas, then Building 20 was literally at the center, serving as MIT’s magical incubator for such diverse fields as information theory, cybernetics, neural networks, linguistics, neuroscience, and computer science. Researchers roaming the building included Claude Shannon, Norbert Wiener, Warren McCulloch, Walter Pitts, Noam Chomsky, Jerry Lettvin, and Marvin Minsky. The intellectual ferment eventually converged in the ambitious attempt to understand intelligence and to replicate it in machines. Marvin Minsky and Seymour Papert were both key in launching the field of artificial intelligence, while Noam Chomsky and David Marr pioneered cognitive science and computational neuroscience.

Over the last five decades, the field of A.I., together with its more recent offsprings – machine learning and neural networks – has quietly led to a host of technologies that are changing our lives, beginning with computers becoming grandmasters of chess and leading into Google search, speech recognition, face detection in digital cameras, cars that see, and computers that win at Jeopardy. None of these systems and machines, however, could really be called intelligent. The problem of intelligence, of how the brain generates it and of how to make really intelligent machines, is still wide open.

The Problem of Intelligence
Intelligence presents one of the greatest problems in science today. It is arguably the main tool we utilize in understanding all other great problems in science. Great minds have puzzled over it for centuries. Solving it would ultimately require understanding how the brain works, how to build machines as intelligent as we are, and how to develop more intelligent organizations. Even a partial solution of the problem of intelligence has great potential benefits for our society, technology, and economy. Should we try to revisit the problem of what intelligence is?

Why Now? And Why at MIT?
There are multiple reasons. Today the key fields of cognitive science, neuroscience, and computer science/artificial intelligence are re-converging. This convergence is driven by new powerful tools which allow studies of the brain and the mind that inform the design of intelligent artifacts and vice versa – a loop from science to engineering and from engineering to science. These new tools include a dramatic increase in computing power and storage, the availability of massive datasets, the development of mathematical frameworks for learning, and the broad progress in neuroscience over the course of the last five decades.

An initiative at MIT which incorporates faculty across the Institute’s five schools, whose work bears on the nature of intelligence – in humans or animals, in machines or molecules, in cultural or collective settings – would concentrate a unique set of diverse disciplines and brainpower on one of the greatest problems of science.

Brief History of I²
The idea of an Institute-wide effort, across departments and schools, was triggered when Provost Rafael Reif challenged the faculty to think boldly about the future. Josh Tenenbaum, Professor in the Department of Brain and Cognitive Sciences, Marc Kastner, Dean of the School of Science, Mrganka Sur, Head of the Department of Brain and Cognitive Sciences, and I started a series of formal and informal discussions that led to a one-day workshop among MIT faculty (almost 60 MIT faculty members and a few special guests from Harvard continued on page 4
Recently several proposals have been funded including:

- Bridging robotics and neuroscience
- Social and collective intelligence
- Language, perception, and intelligence; and the development of intelligence in minds, brains, and machines

of neural networks. Since it is about time for a new epidemic, we hope that the Intelligence Initiative (see IP@MIT, http://isquared.mit.edu/) will be at its center. IP is an effort to focus the enormous range of intellectual resources at MIT on the great problem of intelligence.

Thanks to the help of Dean Marc Kastner, and the other MIT deans, IP is now supporting eleven IP Seed Projects, for a total of seven postdoctoral fellowships. The projects span Computer Science, Sloan School of Management, Mechanical Engineering, the Media Laboratory, and the Department of Linguistics.

The plan of IP is to target both research and education in an integrated way. The focus will be on developing faculty, graduate students, and postdoctoral fellows who can carry out highly interdisciplinary and collaborative work. In the meantime, the McGovern Institute has made space available on the fifth floor of McGovern building for an IP laboratory (offices and lounge) open to postdoctoral and other members of the Intelligence Initiative.


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Support the MIT School of Science

MIT’s School of Science is an amazing enterprise, conducting research at the most exciting frontiers of science. By constantly pushing the limits, we are discovering answers to deep philosophical questions and problems with obvious practical implications. Supporting these brilliant and creative minds will take more effort and resources than ever before. We encourage your involvement.

THE FUTURE OF MIT’S LEADERSHIP DEPENDS ON MAINTAINING STRENGTH IN THE SCIENCES

- Support the Intelligence Initiative and become involved in one of the most intellectually challenging problems of our time.

- Mathematics is the language of MIT. Support the continued recruitment and retention of faculty like Professor Scott Sheffield and graduate student Martina Balagovic by giving to the Math Special Needs fund.

- The School of Science hopes to be able to offer every incoming graduate student a full one-year fellowship. Support the effort in EAPS to create a fellowship in honor of Professor M. Nafi Toksoz founder of the Earth Resources Laboratory and former housemaster at Baker House.

- Support the Lorenz Center, a new climate think tank devoted to fundamental inquiry. Mark your calendar for the inaugural John Carlson public lecture to be held at MIT on October 20, 2011, with Professor Paul Hoffman.

Giving Online

You can make a gift online by visiting giving.mit.edu and entering the desired fund name or number in the "search designations" box.

Intelligence Initiative: 2744454

Math Special Needs Fund: 3879500

Professor M. Nafi Toksoz Fellowship Fund: 3311750

Lorenz Center: 3891230

For more details on any of these initiatives or to discuss other ways to support the School of Science, please contact Elizabeth Chadis, Assistant Dean for Development at (617) 253-8903 or echadis@mit.edu.
Support the MIT School of Science

Elizabeth Chadis
Assistant Dean for Development
MIT School of Science, 6-131
Cambridge, MA 02139

Tel: (617) 253-8903
Email: echadis@mit.edu

Make You Anywhere

Alumni recently were recognized. The Dean’s Colloquium in Science but have outstanding accomplishments outside...