THE JOHNS HOPKINS
SCIENCE OF LEARNING INSTITUTE

Understanding and Improving Learning Throughout Life
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LAUNCHING A BOLD AND PROMISING INITIATIVE—WITH YOUR HELP

Learning is a fascinating process that is vital to lifelong success, yet we are only now beginning to understand how it works. At Johns Hopkins we have made enormous strides in understanding the brain and mind and are on the brink of knowing how genetics, environment, brain chemistry, and other influences combine to foster or inhibit learning. These strides, however, are taking place in disparate disciplines that sometimes act in isolation and fail to create the necessary synergies to accelerate progress and deepen understanding.

To create this synergy, we have launched the Johns Hopkins Science of Learning Institute, an ambitious, cross-disciplinary effort to understand learning in all its phases and manifestations, including how the brain changes through learning, how development and aging affect our ability to learn, how neurological and psychiatric diseases disrupt or change learning, and why there are such vast individual differences that occur naturally among learners.

Building on existing faculty expertise, and with the generous support of committed alumni and friends like you, the Science of Learning Institute will accelerate science-to-practice translation along the continuum of learning—from basic research in molecules and genes to an understanding of the nature of human cognition, to the creation of effective public school policy that reflects these advances. A central part of our mission will be to determine how new technologies and new educational programs can optimize learning—whether it occurs on the playground, in the classroom, through a rehabilitation program or on-the-job training.

No university has ever focused on learning with an initiative so bold and so promising. We invite you to join us in creating the Johns Hopkins Science of Learning Institute.

A CALL TO ACTION

Rising to the Challenge: The Campaign for Johns Hopkins will raise unprecedented levels of support to attract, sustain, and further empower the people of Johns Hopkins—our students, faculty, and researchers—who through their work improve the lives of millions around the world. Together with our philanthropic partners we will:

ADVANCE DISCOVERY AND CREATIVITY through support of our exceptional faculty and researchers. Their innovative work drives the development of new knowledge, new forms of expression, and new ways to save lives and improve health, and furthers progress across our core disciplines in science and technology, the humanities and arts, and public health and medicine.

ENRICH THE STUDENT EXPERIENCE by investing in scholarships and fellowships, inspirational spaces for collaborative learning and social opportunities, and new programs that will enhance student-faculty interactions, ensure diversity on campus, link learning in the classroom to life after graduation, and strengthen connections between our students and our surrounding communities.

SOLVE GLOBAL PROBLEMS AS ONE UNIVERSITY by creating new cross-disciplinary solutions in crucial areas such as sustaining global water resources, revitalizing America’s cities, advancing individualized and population health, and understanding how we learn and teach.

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The Science of Learning Institute will become a world center for research on learning. Through this innovative organization, we will lower the boundaries between research and practice, combining the two in a single, mutually reinforcing effort. The institute will stimulate discovery by creating new synergies across the traditionally distinct fields of neuroscience, cognitive science, psychology, genetics, computer science, and education. We will analyze brain imaging utilizing our advanced computing capabilities, and apply our expertise to understand the molecular and genetic properties of the brain and enhance our ability to model human cognition.

**THE ELEMENTS ARE ALREADY IN PLACE**

Johns Hopkins demonstrates unmatched expertise and accomplishment at all levels of learning research, from cellular and molecular science to education and public policy. We were at the vanguard of neuroscience research well before the term was coined in the late 1960s. Johns Hopkins scientists were the first to discover the organization of the cerebral cortex, the first to demonstrate how the polio virus infected peripheral nerves, and the first to describe receptive fields in the visual system. We already have more experts on learning than almost any institution in the world. More than 500 of our 3,000 faculty work on some aspect of brain science. Professors in the Krieger School’s departments of Cognitive Science and Psychological and Brain Sciences, and the School of Medicine’s department of Neuroscience, lead strong research programs and train students in top-ranked doctoral programs. Our Whiting School of Engineering is home to experts in data-intensive science who are re-engineering systems with implications for our national security. Our Applied Physics Laboratory employs more than 3,000 scientists and engineers, many of whom now work on the human-machine interface. The Johns Hopkins School of Education has unparalleled expertise in urban schools and classroom interventions, and our Center for Talented Youth is a world leader in nourishing the best young minds. With your help, the Science of Learning Institute will bring all of this expertise together in a focused manner that has never been accomplished before.

**PRODUCING A ‘STATE CHANGE’**

“Scholars in many fields have come to recognize that many of the deepest problems we face will be solved only by engaging expertise across traditional boundaries. However, universities still have departments which tend to be organized along more traditional disciplinary lines. This means that the interdisciplinary approaches and solutions will reach a tipping point only to the extent that there are incentives to work across traditional lines. A powerful mechanism for reaching that point is to recruit faculty who are relentlessly interdisciplinary and can produce a state change in which new scholarly synergies emerge, fresh new insights on the hardest problems are generated, and the next generation is trained from early on to speak the multiple languages of different disciplines. This state change reinserts the university’s approach to our most pressing problems and is at the heart of the Science of Learning Institute.”

-- David W. Andrews, PhD

**HENDERSON-HOPKINS SCHOOL: A NATIONAL MODEL FOR PERSONALIZED LEARNING**

When students walk into the new Henderson-Hopkins School in East Baltimore next fall, they will enter a unique learning environment—a comprehensive, cross-disciplinary approach to personalized learning that combines innovative technologies, instruction, and curricula within an environment of continuous individualized learning and assessment. According to David Andrews, “By taking all the assessment data from kids and making it much more granular and frequent, we can create what we call embedded assessments, so that every time a child does something, we’re gathering information about her or his performance. Then we can make adjustments on a daily basis of everything from the amount of time the student spends at a particular technique to using synchronized tutors in the classroom.”
The Science of Learning Institute seeks to understand learning at the very basic level and to maximize learning in all its human manifestations, from the infant, to a typically developing child, to the challenged learner, to the individual recovering from injury. As such, the institute will focus on five areas of learning: language, memory, attention, spatial cognition, and decision-making.

Individual Differences in Learning will investigate how learning differs from person to person and changes within the same individual over time. For example, people differ markedly in their working memory—the ability to retain information to work with as they solve problems. Such differences in learning may be enhanced or diminished with varying effects of training, aging, and the manner in which materials are presented: in a classroom, alone with a computer, or in another setting entirely.

The Applied Science of Learning takes knowledge from the laboratory and uses it to optimize learning for the individual. Work in this area will involve faculty from our School of Education joining with cognitive scientists, neuroscientists, and engineers to test new discoveries via activities, technology, curricula, and learning environments, employing the latest scientific information about how people learn. The goal is to tailor classroom and other modes of education as closely as possible to an individual’s needs and capabilities, eliminating the one-size-fits-all approach that has served us so badly.

Human-Machine Learning will focus the capabilities of our mathematicians, computational and cognitive scientists, neuroengineers, and neuroscientists on the design of artificial machine learning systems that operate in ways that biology cannot. The IBM Watson system is a testament to the power of machine learning approaches, with commercial application of the Watson technology now found in the medical domain. Hybrid learning systems that delegate the most important and difficult problems to humans, while automating the more common but less impactful analyses, can further enhance the value of machine learning systems. Understanding how machines enhance human learning presents the opportunity to develop the next generation of hybrid human-machine learners, augmenting human learning capacity beyond its natural state.
course of a few hours,” says Jacob Vogelstein. “However, if we are to build autonomous devices that emulate the operation of the brain, our circuits must function in real-time.” Vogelstein’s research has produced reconfigurable hardware networks of silicon neurons that are capable of operating in real-time, providing a glimpse into the world where machines can assist humans in understanding and analyzing massive data sets.

Understanding how we learn can help us address complex educational, social, and economic issues we face as individuals, families, communities, and cultures. It also holds tremendous promise for the treatment of disease, learning disorders, and brain injuries. The more we grasp the workings of the brain and mind, the better we can help those recovering from stroke or other brain trauma. In the process, we may discover enhanced therapies or cures for Parkinson’s, multiple sclerosis, or Alzheimer’s disease. Further investigations may establish the framework from which we can predict potential learning boundaries or opportunities and, in turn, create strategies for early intervention. The possibilities are tremendously exciting. With your help, the Johns Hopkins Science of Learning Institute will transform lives.

HOW LEARNING REWIRES YOUR BRAIN
“We are very interested in the intersections between learning and memory. For a memory to last decades, something physical changes in the brain that also lasts for decades. In our lab, we look at the synapses that help cells communicate with each other and how learning changes that physical process to rewire the brain in order to encode the memory. We’ve identified a variety of molecules that are involved in this process, which turn out to be important in many neurological diseases, as well as schizophrenia, Alzheimer’s, and autism.”

Making microchips that work like the brain
Our brain is a powerful and complex computer, performing a multitude of simultaneous computations every microsecond. In order to understand the complex biological systems that contribute to learning, computational models are used to simulate the series of interconnected cells providing this natural processing power. “Traditionally, these simulations are generated in software and executed over the course of a few hours,” says Jacob Vogelstein. “However, if we are to build autonomous devices that emulate the operation of the brain, our circuits must function in real-time.” Vogelstein’s research has produced reconfigurable hardware networks of silicon neurons that are capable of operating in real-time, providing a glimpse into the world where machines can assist humans in understanding and analyzing massive data sets.
TAKING THE NEXT STEP TO MAXIMIZE OUR LEARNING POTENTIAL
The Johns Hopkins Science of Learning Institute can succeed only through philanthropy. We seek to raise $100 million to attract luminary professors and students and support new research that cannot be obtained through the standard research funding channels.

LEARN AND SHARE
Visit rising.jhu.edu to learn more about the institute and to hear directly from faculty and students engaged in research. Share your thoughts with us and help spread the word through your professional and personal networks.

MAKE A GIFT
Please contact us so that we may help you explore gift opportunities and plan and structure gifts that answer your goals and ours.

CONTACT US TODAY
To pursue any of the options listed above, please contact:
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