

New England Science Symposium Keynote Speaker

Donald E. Ingber, MD, PhD

“THE BOUNDARIES BETWEEN disciplines are breaking down,” says Donald E. Ingber, MD, PhD, who will be the keynote speaker at the New England Science Symposium on April 6. It is by working across disciplines, he maintains, that scientists can achieve — and are achieving — transformative breakthroughs. As the founding director of the Wyss Institute for Biologically Inspired Engineering at Harvard University, Judah Folkman Professor of Vascular Biology at Harvard Medical School and the vascular biology program at Boston Children’s Hospital, and professor of bioengineering at the Harvard John A. Paulson School of Engineering and Applied Sciences, Ingber is uniquely positioned to address this topic. It is the core of his career and, he believes, the primary reason he was chosen to lead the Wyss Institute, which is focused on discovering nature’s design principles and on harnessing these insights to create bioinspired technologies to advance human health and create a more sustainable world.

The breakthroughs coming out of the Wyss Institute result from the convergence of many disciplines, including biology, medicine, physics, computer science, design and engineering. Though he has never formally studied engineering, Ingber says, “I learned on the fly. I learned from my students. I learned from my collaborators.”

Ingber also has helped to break down boundaries between science, art and design. His Organs-on-Chips, created with microchip manufacturing methods and lined by living human cells, are being used to replace animal testing as a more accurate and

affordable *in vitro* platform for drug development and personalized medicine. In 2015, the technology was named Design of the Year by the London Design Museum and was also acquired by the Museum of Modern Art (MoMA) in New York City for its permanent design collection. Organs-on-Chips were also named one of the Top 10 Emerging Technologies of 2016 by the World Economic Forum.

He credits a freshman year art class at Yale University, from which he earned his BA, MA, MPhil, MD and PhD, for the light bulb moment that set his future course. Ingber recounts that his professor brought in a “tensegrity” sculpture, made of sticks and elastic strings, a system first described by architect Buckminster Fuller and the sculptor Kenneth Snelson. Watching the professor push the sculpture flat then release it to let it pop up reminded Ingber of the way he had seen cells behave in a lab when he learned to culture them. He relates that he then assumed cells must be tensegrity structures. This juxtaposition of science and art led him to think about biology in an entirely different way than his peers or mentors, believing mechanical forces are as important bioregulators as chemicals and genes.

While he was in medical school, Ingber says, “I loved seeing patients. I loved surgery, medicine and even psychiatry. But I thought I could have a greater impact on more people through science.” After receiving his MD/PhD, Ingber conducted cancer research in the lab of Judah Folkman, MD, at Harvard, studying cell shape and growth control in the context of tumor angiogenesis — the



DONALD E. INGBER, MD, PHD

growth of capillary blood vessel cells that solid cancers require for their sustained expansion. Over the years as he worked to test his hypotheses about physical forces regulating cell and tissue development, Ingber sought out specialists in other fields — physics, chemistry, engineering, magnetism, computer science. And his multidisciplinary group was able to confirm that cells are indeed built like tensegrity structures and that mechanical forces are critical to the control of cell growth and function, as well as wound healing, organ formation and many different disease processes, including cancer.

In 2005, the provost of Harvard asked Ingber to co-chair a committee to envision the future of bioengineering across the university and its hospitals. The faculty group noted that engineering had transformed medicine over the past 50 years by applying engineering principles to solve medical problems. However, they also recognized that we were approaching a tipping point because our knowledge about how nature builds, controls and manufactures has expanded enormously. As a result, they realized that it is now possible to leverage biological principles to develop new



DONALD E. INGBER, MD, PHD

CONTINUED FROM PAGE 1

engineering innovations. They called this “biologically inspired engineering,” which they believed could transform medicine as well as non-medical areas. This concept led to the founding of the Wyss Institute, which

Ingber has led for the past 10 years, since its birth in 2009.

Ingber first participated in the New England Science Symposium in 2016 when one of his students was an award recipient, and members of his staff regularly meet with BSCP students. Ingber advises anyone

interested in a career in biomedical sciences, “Follow your passion. Don’t try to map out what you think you need to do to succeed.”

His path has been anything but preordained. ■

