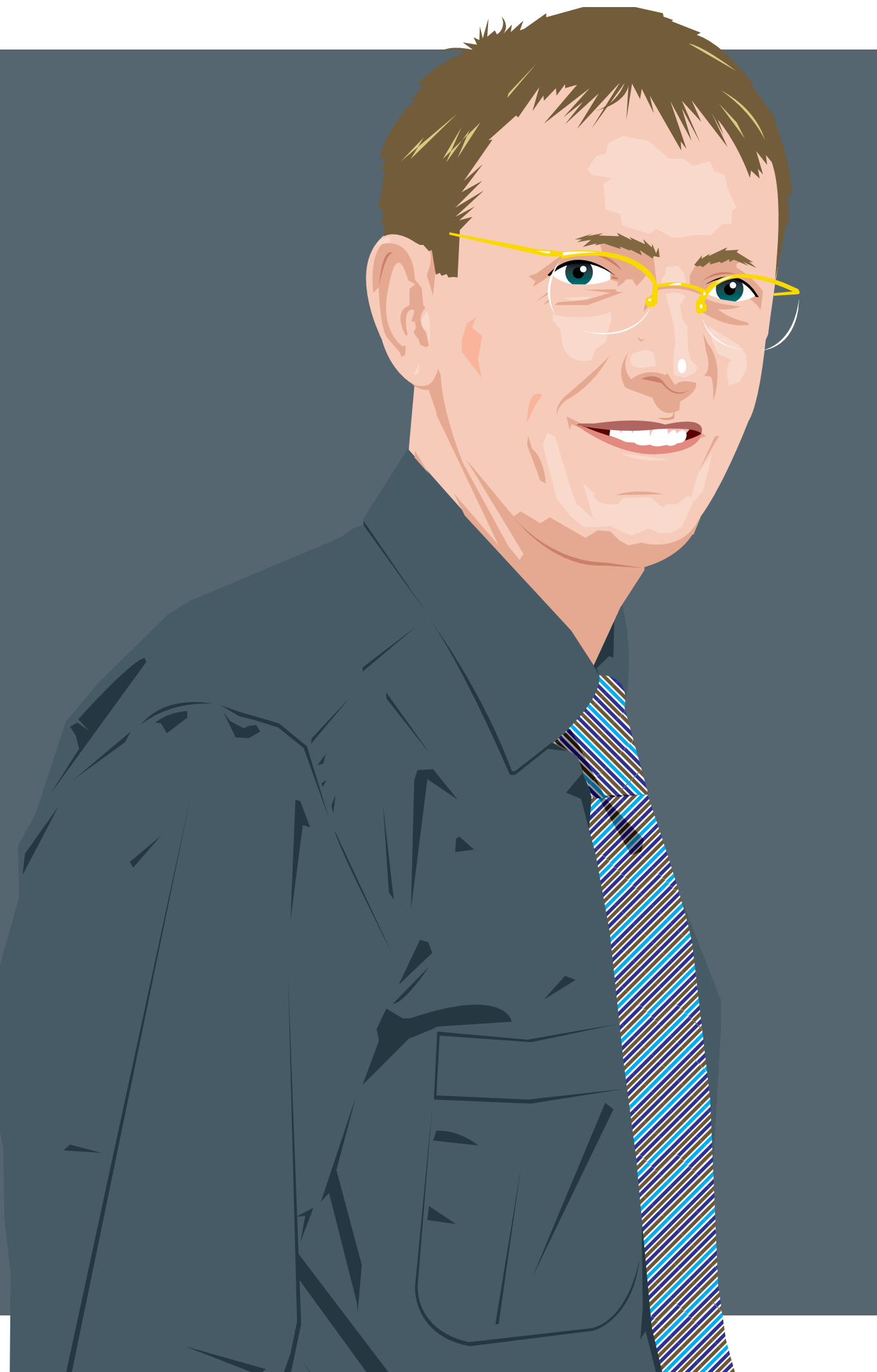


# THE POWER PLAYERS

## REVOLUTIONARY MINDS

“THE ATTEMPT TO COMBINE WISDOM and power,” Einstein said, “has only rarely been successful and then only for a short while.” Indeed, power is easy to abuse and even easier to squander. In this, the fourth installment of *Seed’s* Revolutionary Minds series, we profile six top-tier leaders who, by using their influence in surprising and unconventional ways, are creating a unique brand of scientific legacy. This group is pulled from a variety of sectors and together represents a shift in the power equation. Their collective wisdom and impact resides in their natural insistence on cross-disciplinary work and open access to the results. By expanding notions of who should participate in research and who should benefit from it, they are laying the groundwork for the future of the scientific enterprise. — *Emily Anthes*

ILLUSTRATIONS BY QUICKHONEY



JANEZ POTOČNIK  
EUROPEAN UNION

IN THE WORLD POPULATED by the members of the European Commission—the executive branch of the EU where legislation is drafted and policies are implemented—Janez Potočnik is the man who speaks for science. His mission, as he explains it is, “to improve the situation for research and researchers in the European Union.”

Potočnik, a Slovenian, is the European commissioner for science and research, a pursuit the EU is funding to the tune of 50 billion euros between 2007 and 2013. He is working to create a world-class, international research community that showcases globalized science. The results will be valuable to other researchers facing similar pressures.

“Science is becoming increasingly complex and costly,” he says. “It therefore makes sense for the EU to create opportunities for scientists to collaborate across country borders, to create platforms where the scientific community and industry can come together, and to provide financial resources for research projects that span several countries.”

Earlier this year, Potočnik helped inaugurate the European Research Council, a pan-European agency devoted to funding investigator-driven research at the frontier of scientific knowledge. Or, as Potočnik calls it, Europe’s “ideas factory.” From the beginning, Potočnik fought to establish the council’s independence and freedom from political interference, “in spite of significant opposition,” says Iain Mattaj, director-general of the European Molecular Biology Lab. Potočnik “has always placed the goal of achieving a well-functioning European research system above increasing his personal political profile.”

Potočnik is generally regarded as a diplomat who actively seeks the opinions of others. Earlier this year, he launched an initiative to solicit commentary from European institutions and individuals about how the continent can foster a more unified scientific community. He has already received more than 800 responses on issues ranging from the creation of a single labor market for European scientists to the development of EU-level policies governing information sharing among researchers.

“If we achieve what I think we can, then in the next few years, the European Union could be among the world leaders in a number of new technologies,” Potočnik says. “Our pharmaceutical industry will be producing new therapies. We will be helping developing countries with technologies for things like water purification, and reducing the polluting effect of fossil fuels.” He recognizes what’s at stake. “The globalization of research and technology is accelerating daily,” he says. “The EU cannot stand still.”



**HAROLD VARMUS**  
PUBLIC LIBRARY OF SCIENCE

**HAROLD VARMUS DID NOT BECOME** an open access advocate quietly. In 1999, when he was director of the NIH, he published a short paper calling for a radical rethinking of scientific publishing: He proposed making biomedical research papers freely available online. The reaction was not what he'd hoped for. Colleagues, publishers, and others responded with anger, he recalls, saying, "It got me in a lot of trouble."

Since then, open access has come a long way and has reshaped scientific publishing. Varmus remains one of its driving forces. He is best known within the movement for his role in cofounding the Public Library of Science ([www.plos.org](http://www.plos.org)), which now publishes an array of not-for-profit peer-reviewed journals that offer immediate and free access to content online.

Last year, Varmus upped the ante on open access by launching PLoS ONE, which he describes as an encyclopedic, large-scale publishing device. A paper submitted to PLoS ONE is not subjected to extensive review, but is instead evaluated by a single criterion: Is it good science? Papers that pass this hurdle get posted in online forums where readers can annotate them, comment, or submit related findings. The result, Varmus says, is that data and ideas that might otherwise never see the light of day can be openly debated and discussed. "We think this is very healthy," he says. This fall, just 13 months after PLoS ONE began taking submissions, it accepted its 1,000th paper for publication. And the original editorial board of 120 people has now grown to nearly 400.

Open access continues to have its critics, but the pendulum is swinging in its favor. This fall, the US Congress passed legislation requiring that papers resulting from NIH-funded research must be made publicly available. And other major funding agencies, including the Canadian Institutes of Health Research, Howard Hughes Medical Institute, and the Wellcome Trust in the UK, have already instituted similar policies.

Varmus—who is a Nobel Laureate and currently serves as the president of the Memorial Sloan-Kettering Cancer Center—has helped make open access publishing visible, credible, and even mainstream. "He's been at the epicenter of the movement since its inception," says Heather Joseph, executive director of the Scholarly Publishing and Academic Resources Coalition. "He's got that winning hand of seeing beyond the way things are, into what they might become, backed up by realistic ideas of what it might take to get there."





SUSAN HOCKFIELD  
MIT

**MIT PRESIDENT SUSAN HOCKFIELD**, who in 2005 became the first woman and first life scientist to head the research institution, was already guaranteed a spot in the history books. But these “firsts” may be mere footnotes to Hockfield’s real contribution: At a time when the most ambitious projects of many university presidents involve merely looking within their institutions—to refashion college admissions, for instance, or overhaul a core curriculum—Hockfield is assiduously breaking down barriers between academia and the world outside it, creating a model of what a 21st century research university should be.

This fall, Hockfield is preparing to roll out the second phase of OpenCourseWare, an online platform that makes materials for all of MIT’s 1,800 courses freely available to the public. OpenCourseWare, launched in 2003, is already immensely successful, with as many as 50,000 visits a day, half of them from users outside the US. “It really represents a powerful way to democratize education,” Hockfield says.

The next stage will feature a portal to the materials that is specifically designed for high school students and teachers. “[Hockfield’s] been pushing very hard to do things at lower levels,” says Bruce Alberts, a former president of the National Academy of Sciences and a member of the OpenCourseWare advisory committee. “Most universities and university presidents don’t pay much attention to pre-college education. MIT’s really making an investment in that area.”

Under Hockfield’s leadership, MIT is also engaging the outside world in a problem of a global scale: sustainable energy. In 2005, Hockfield convened an energy research council, which included faculty from all five of MIT’s schools. The council labored for a year to lay the foundation for the MIT Energy Initiative. The expansive enterprise now encompasses research in nuclear fission, biofuels, energy sequestration, urban design, and more. There has been “an explosion of interest” in energy research on campus, Hockfield says, and more than 15 percent of the faculty—from wide-ranging fields—have already written white papers for the initiative.

Hockfield has also made industry an important part of the effort, announcing multi-million dollar partnerships with BP and Ford. The companies will fund research collaborations between MIT and industry scientists, MIT energy fellowships, and more. “The problems that are posed in the energy challenge require input from more than a single discipline,” Hockfield says. “No solution is going to be deployed individually—they will be deployed in some kind of interesting combination.”



**PETER NORVIG**  
GOOGLE

GOOGLE HAS BECOME well known for what it calls “20 percent time,” a philosophy that encourages the company’s employees to spend one-fifth of their time on projects of their own choosing. But in Google’s department of research, this idea is taken a step further: “It’s 100 percent 20 percent time,” says Peter Norvig, Google’s director of research.

The company’s 100-plus research scientists are given great freedom to pursue their ideas, and it’s up to Norvig to help

make something of them. “My role is in making connections—to go around to various teams and say, ‘Oh, you’re working on this? Here’s another group in the company that could use that technology,’” he says.

Norvig, an expert on artificial intelligence who once headed up NASA’s computational sciences division, has led Google research since 2005. He has aimed to expand its efforts, which he says were focused too narrowly on search technology. The scientists he oversees now work across a broad spectrum of areas—including linguistics, learning, and cryptography—making contributions to both Google’s long-term goals and the scientific enterprise.

“Right now, if you’re a computer scientist and you want to change the world, Google is one of the places to be,” says Paul Saffo, the Silicon Valley technology forecaster. At Google, Saffo says, Norvig “gets enormous respect. He’s a deep-water scien-

tist with real entrepreneurial experience.”

It’s Norvig’s job to evaluate the scientists’ projects, pushing investment of the company’s resources into promising areas. For instance, he is especially excited about visual processing research, which will allow a computer to search for images by actually recognizing faces and objects, rather than by searching for associated keywords. “It’s a whole new vocabulary,” Norvig says.

The scientists work closely with engineers to create Google products, but their efforts are more far-reaching. Google scientists often submit their work to scientific journals, but Norvig expects them to go beyond publishing a single result and include the entire process of turning a result into a product. “You write the paper,” Norvig says, “and in the final section instead of saying, ‘Here are all these questions for future research,’ you say, ‘Here are all these answers.’”



**ERIC LANDER**  
BROAD INSTITUTE

IN ORDER TO DECODE the human genome, Eric Lander had to bring together scientists from diverse fields, backgrounds, and specialties. “We were assembling teams that were taking on a task bigger than any of us,” says Lander, who was then the director of the Whitehead Institute/MIT Center for Genome Research and the flagship team of the Human Genome Project. As the end of the sequencing came into view, the scientists started looking toward the future. “We didn’t want to lose the com-

munity that had been born of the Human Genome Project,” he says.

And so, Lander helped build the Broad Institute, one of the world’s leading centers for research in genomics and medicine. Launched in 2003 as a joint venture between MIT and Harvard, the Broad was created to bring scientists from different institutions together to enable endeavors in “big science”—the human genome projects of the coming decades.

Lander became the founding director of the Broad Institute and the teams that had worked on the human genome became its nucleus. Today, the institute has more than 100 affiliated researchers spread out over the city of Boston and its labs. Once a week, all the scientists whose work touches on a given topic—cancer genomics, for instance—congregate at the Broad to discuss their current research. This structure allows them to explore opportunities to

collaborate on future projects no single scientist could accomplish alone.

The Broad is leading the way, for example, on an \$18 million project that will develop tools for researchers whose work involves gene silencing. The effort involves creating 150,000 unique plasmids, each of which contains an RNA sequence that can be used to inhibit specific genes.

The scientists who work at the Broad Institute “chase after really hard and really important problems in biology and medicine,” says Francis Collins, director of the National Human Genome Research Institute. Collins calls Lander “the leading intellect of the genomic era,” and says many other research groups are considering replicating the structure of the Broad. “Its greatest influence,” he says, “will probably be the young scientists who train there, who will never be satisfied with the old way of doing things.”



**TADATAKA YAMADA**  
BILL + MELINDA GATES FOUNDATION

**TADATAKA YAMADA WITNESSED** the challenges of global health care firsthand. As the head of R&D at Glaxo-SmithKline, he watched controversy unfold over the company's allegedly excessive prices for its HIV medication in South Africa. Yamada was "horrified and offended," he says. "I felt that we should be very much engaged in making sure that we could contribute something to diseases of the developing world." So he founded a new laboratory devoted to illnesses that disproportionately affect developing nations, such as malaria and TB, staffing it with some of the company's most talented scientists.

It was in the course of this work that he came into contact with the Bill & Melinda Gates Foundation, and during his first visit there, in the fall of 2005, CEO Patty Stonesifer approached him. She invited him to direct the foundation's global health program, which funds the development and delivery of vaccines, drugs, and other health interventions in the developing world. Yamada took the job and now oversees the program's deep grant portfolio. Since its inception, the program has awarded more than \$8 billion, giving it—and Yamada—nearly unrivaled influence in the global health community.

But Yamada wasn't content to let the foundation merely continue with business as usual. "It became clear to me that we were focused on just part of the overall task at hand, which was developing solutions from what I would call 'low-hanging fruit,'" he says. "For example, there's been a massive effort to try to find a vaccine for HIV, but every time we've tested our concepts we've failed in clinical trials. We have to cast a broader net to seek out really novel ideas."

Effective new ideas for conquering HIV might originate with researchers who have never worked on the virus before, Yamada says. His thinking along these lines resulted in the foundation's announcement this fall of a new initiative, Grand Challenges Explorations. The initiative will award \$100 million in grants over five years—concentrating in particular on unorthodox and intellectually risky ideas that might otherwise not receive funding. By giving such research support, Yamada hopes to enable the development of effective new health solutions.

Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, says Yamada brings "strong vision and leadership" to the philanthropic organization. "Dr. Yamada, in the relatively short time that he has been at the Gates Foundation," Fauci says, "has brought a fresh, new approach toward tackling some of the most difficult problems in global health."

