AN OPEN-SOURCE MODEL FOR INNOVATION

Cherry A. Murray takes the helm at the School of Engineering and Applied Sciences
For Cherry Murray, boundaries — between art and engineering, campy science fiction and the classics, academic disciplines and scholars — exist only if you build them.

The new dean of the Harvard School of Engineering and Applied Sciences (SEAS) sees no contradiction in celebrating the spirit of innovation in both its pure form and its more fantastic one, where the rules of physics are relaxed for the sake of a good yarn. Fond memories of watching the 1969 moon landing in a crowded living room in South Korea, where she was living at the time, sit in easy compatibility with memories of a day eight years later, when she stood in line to witness a different kind of space saga, becoming among the first to see Star Wars.

Murray, who came to SEAS from the Lawrence Livermore National Laboratory (LLNL), where she was principal associate director for science and technology, is a natural advocate — and practitioner — of interdisciplinarity. Until ninth grade, when a young chemistry teacher showed her the “beauty” of math and science through assignments that were sufficiently challenging and right-brained, Murray planned to become an artist like her parents. Her decision to study physics was, in part, the result of a dare from her older brother, who came home from MIT and declared that “there was no way” she could handle the subject, let alone get into MIT. Murray went on to earn two MIT degrees in the field, a BS in 1973 and a PhD in 1978, proving him doubly wrong.

But the switch did not commit her to an “either/or” paradigm. A print of a brilliant-orange Georgia O’Keeffe flower hangs in her office in Pierce Hall, at home alongside nanotechnology-inspired images by physics faculty member Eric Heller.

TOLERATING WEIRDNESS, SHARING COOLNESS

“Follow what you like doing, and if you do it well, you’ll get a job,” Murray once told a group of female students at the New Jersey Institute of Technology. In her case, channeling a passion for applied physics also attracted mentors and guides, who came together to form a strong web of support.

At MIT in the late 1970s, Murray was one of just three women studying physics; the entire faculty included only two women. One of the two, Mildred (“Millie”) S. Dresselhaus, became an unexpected advocate.

“Millie pulled me aside one day and said, ‘I remember your application in particular,’” Murray said. Dresselhaus, intrigued by Murray’s artistic accomplishments, made an effort to get to know her,

Solving the big problems will demand big thinking across the disciplines, Murray says.

A multidisciplinary team of computer scientists, engineers, and biologists is developing ROBOTIC BEES that might one day artificially pollinate plants and flowers.

Professor Federico Capasso and colleagues have succeeded in “levitating” a tiny object; the REPULSIVE QUANTUM MECHANICAL FORCE they measured could be harnessed and tailored for a range of nanotechnology applications, including nanoscale machines.

Bioengineer Rob Howe and doctors at Children’s Hospital Boston are developing a robotic system that could allow HEART SURGERY to be performed while the heart continues beating, eliminating the dangers associated with stopping the heart.

RIGHT NOW AT SEAS • RIGHT NOW AT SEAS • RIGHT NOW AT SEAS • RIGHT NOW AT SEAS • RIGHT NOW AT SEAS
Joining Bell Labs right after earning her PhD, she worked under Arno Penzias, then the vice president of research, who soon became her role model administrator. “Arno cultivated a culture of toleration,” explains Murray. Eccentricity, diversity, and even arrogance were accepted at Bell, justified by the lab’s remarkable productivity (inventing modern telecommunications) and penchant for Nobel Prizes (six in six decades). More broadly, the innovative powerhouse “tolerated weirdness,” Murray says, recalling a mathematician who walked backwards (all the time). Another researcher wore “short-shorts and a pith helmet every day of the year.”

While she “backed into management roles,” eventually becoming a senior vice president at Bell, Murray soon realized an open secret, one she suggests graduate students and young researchers consider before balking at the idea of entering the bureaucracy. “You get the control, the money, and the direction,” she says of taking on administrative positions. “And if you take the job,” she adds, “you will not be working under someone you may not want to work for.”

Influenced by the open structures at Bell and LLNL, she dislikes empire builders. She is looking to nurture an organic environment at SEAS. And while she’s pragmatic and decisive, Murray says she also wants to foster “what’s cool.” Murray doesn’t see “coolness” as isolated and exclusive to technology, but rather as something that should be celebrated — and shared across disciplines.

**Materials scientist Michael Aziz has developed a potentially viable **carbon sequestration** process. Now his technology may lead to greener cement and concrete, shrinking a large carbon footprint.

**By mathematically modeling how a humpback’s flipper allows the massive mammal to fly through the water, applied mathematician Michael Brenner and colleagues may one day help engineers **build better blades and wings** for aircraft and wind turbines.

**Joanna Aizenberg and colleagues have discovered a way to **synthesize and control** the formation of nanobristles, akin to tiny hairs, into highly ordered helical clusters. This “clumping” has potential for energy and information storage, photonics, and adhesion, among other functions.**

**SYSTEMS-LEVEL THINKING**

In the coming year, Murray wants to invest in a comprehensive planning process, engaging both faculty and administrators in an effort to determine how best to build upon recent growth at SEAS and strengthen connections to programs within the Graduate School of Arts and Sciences and across Harvard.

While SEAS has existed as a school within the Faculty of Arts and Sciences for just two years, the disciplines that fall under the engineering and applied sciences umbrella have matured enormously over the past decade, bolstering the University’s core strengths in fundamental science and increasing its capacity to translate knowledge into innovative tools and applications. “SEAS has made initial investments in the fields that are growing, such as...”
technology, bioengineering/bio-inspired engineering, information theory, and computational science,” she says. (To find some examples, see “Right Now at SEAS,” preceding pages.)

In keeping with her predecessor, Venkatesh “Venky” Narayananmurti, now director of the Science, Technology, and Public Policy Program at the Kennedy School’s Belfer Center, Murray is eager to tap into the immense breadth offered by the other schools at Harvard, from Business to Divinity.

The network of professional schools, combined with the classical liberal arts environment of FAS, makes SEAS “different than a purely technical institution.” Such positioning, she says, will help dispel the idea that “the applied sciences merely lay down theory” for scientific problems that exist outside the realm of everyday issues. In her view, the mission is much broader, and the applications much more immediate.

She is fascinated, for example, by the work of Stuart Shieber, the James O. Welch Jr. and Virginia B. Welch Professor of Computer Science, who develops computational approaches to language and communication, and who has become a thought leader in the area of open-access scholarship. His work takes intriguing turns — revealing, for example, that the future of publishing relates as much to behavioral economics as it does to novel e-reading devices.

Tackling global health, Murray says, is another “systems-level problem.” Delivering information, minding cultural mores, and managing resources are as important as delivering a cure, and together they call for a complex system akin to the Internet or urban transit.

Murray believes that to create an inclusive network at Harvard to tackle global problems — “issues like the state of the planet, water quality, energy, and the environment,” she says — will take something more than new programs, courses, or research collaborations. It will also take faculty, researchers, and students who can “explain their work” and advocate for its possibilities.

“At SEAS, we already have all the aspects of what is going to be important not just in terms of research, but in terms of the future of society,” she says. She wants to share those specialized resources, advocating an open-source model for innovation and increased interaction with industry partners.

Solving the big problems will require “everything from ethics and economics to biology and applied mechanics,” she says. Luckily, the sources of inspiration are equally boundless.