

Convergent Thinking, Creative Application

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...We are amassing an ever-growing understanding of nature's genius—the exquisitely adapted molecular and genetic machinery cells used to accomplish a multitude of purposes. I believe we are on the brink of a convergence revolution, where engineers and physical scientists are recognizing how we can use this biological ‘parts list’ to adapt these natural machines to our own uses.”

—Susan Hockfield, PhD, MIT president emerita, neuroscientist and author

Dr. Susan Hockfield's exciting and hopeful book, *The Age of Living Machines*, describes how researchers have worked across disciplines and fields to engineer biologically based solutions for complex problems. These solutions—examples of which range from cancer-detecting nanoparticles and mind-reading bionic limbs to virus-built batteries, protein-based water filters and computer-engineered crops—grow from “convergence,” the integration of knowledge from the life and physical sciences and engineering. And Dr. Hockfield eloquently makes the case that convergent thinking offers humanity's best chance to overcome the globe's most vexing challenges.

At Jefferson, we share that sense of the power inherent in convergence. We believe there is a kind of energy created when once-distinct disciplines intersect: the light of the resulting discovery is extraordinary, as is the warmth of human benefit from

applying that discovery. For that reason, we continue working hard to bring people, ideas and resources together in new ways—creating opportunities to apply knowledge, methods and technologies from one field, to questions asked in another.

Research 2021 offers a glimpse of how convergent thinking is manifest across our institution. You can see it, for example, in the multidisciplinary team testing the first brain implants designed to help stroke victims regain limb function; and in the novel solutions developed to address the challenges of caring for COVID-19 patients. Convergent thinking is evident in the ways that our faculty and student researchers are combining research from architecture, industrial design and occupational therapy to develop plans for smart, healthy cities. It is evident too in our hemp industry research and development program, in which faculty and graduate students are using new knowledge about

business systems, policy making, materials science, manufacturing processes and design to lay the foundation for a robust and sustainable new industry.

In addition to its importance in developing solutions, I would argue that convergent thinking can be key to teasing apart the interwoven problems that comprise complex challenges—and to gaining a more nuanced understanding of the interplay between seemingly unrelated causes. The work that researchers across the University are doing to understand disparities in cancer treatment outcomes is an important example. So too is our exploration of psychological and cultural influences affecting caregivers' unrecognized biases about sexual assault victims and patients from underprivileged backgrounds. And our society's lack of convergent thinking on racial issues is the driver for Jefferson faculty research on the inequitable ways that minority communities and journalists are treated by mainstream news media.

Reading *Research 2021* makes clear the extraordinary level of knowledge, skill, creativity and dedication displayed by our faculty, research staff and students. What may not be as clear is the deep institutional commitment that underpins their work: Jefferson continues to invest in the people, systems, technologies and space necessary to advance the University's research enterprise. We are committed to building on areas of strength; to fostering collaboration across research fields and professional disciplines; and to creating an environment highly conducive to discovery, translation and application of new knowledge.

We are determined to provide our researchers the most advanced technical resources possible. The University's new Cryo-Electron Microscopy system, for example, will open new paths of discovery in biomedical science, and will create opportunities for research and development in materials science, textile engineering and physics. And while less technologically sophisticated, our digital research support systems—such as LabArchives, our state-of-the-art, cloud-based electronic research notebook—have been hailed as pioneering ways of fostering a collaborative and efficiently managed research ecosystem throughout the institution.

Jefferson's expanding technical resources and research infrastructure go hand-in-hand with our sustained growth in funding. Our strong commitment to providing internal funding for preliminary studies and pilot grants has been a



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driver for substantial expansion of overall funding: Over the past five years, the University's external funding for research has more than doubled, and the number of clinical trials undertaken has increased approximately 60 percent.

The Jefferson research enterprise is robust and growing. We are having major impact across the research spectrum—from making fundamental discoveries on the nanoscale and atomic levels to the translation and application of new therapies, processes and products in health care, industry, local communities and multifaceted ecosystems.

As the past year made clear, the world relies on dynamic, dedicated and practically focused research institutions like Thomas Jefferson University to drive forward the discovery and application of knowledge. Indeed, rarely in history has there been a similar convergence of unbounded opportunity and fundamental challenge as we have today. Or such an imperative for bridging boundaries—intellectual, professional, economic, political and cultural—as we strive to answer the questions being asked of us in the 21st century.

I invite you to read on and discover the many ways that Jefferson researchers are moving past old boundaries to pursue opportunity and surmount our world's most significant challenges. ■