National coordination needed to advance convergent research

May 7 2014

Convergent research – which crosses disciplinary boundaries, integrating tools and knowledge from the life sciences, physical sciences, engineering, and other fields—could spur innovation and help tackle societal challenges, but greater national coordination is needed, says a new report from the National Research Council. Convergent science still faces hurdles and requires a culture shift for research institutions, which have traditionally organized research around separate disciplines.

Convergent science also relies on forming a web of partnerships to support boundary-crossing research and to translate advances into new products. The report identifies steps institutions and the nation can take to support these partnerships.

"Some of our most difficult real-world problems do not respect disciplinary boundaries, and convergent science, which brings together insights and approaches from many fields, can help us find solutions," said committee chair Joseph DeSimone, Chancellor's Eminent Professor of Chemistry at the University of North Carolina at Chapel Hill and the William R. Kenan Jr. Distinguished Professor of Chemical Engineering at NC State. "It is time for a systematic effort to highlight the value of convergence as an approach to R&D, and to address lingering challenges to its effective practice."

The report identifies areas where convergent approaches could accelerate innovation and help meet broad challenges, including creating new fuels and energy storage systems, meeting the world's need for

secure food supplies in a changing climate, and developing new treatments for chronic illnesses.

Convergent research is already contributing to breakthroughs, the report notes. For example, convergence between the engineering and biotechnology worlds is bringing 3-D printing—which enables custom objects to be built on demand within hours – to medicine, allowing the construction of medical implants customized to individual patients. Researchers are now working to develop 3-D printers that use living cells to construct human tissues and organs for transplants. Doing so will require integrating knowledge from life sciences on how to sustain cells through the printing process, from materials science on scaffolding to support the cells, and from engineering to design and construct the printing devices. Bringing these advances to doctors and patients will require partnerships with industrial, clinical, and regulatory colleagues.

But barriers to convergent science remain, and institutions often have little guidance on how to establish effective programs. The report identifies strategies used by institutions to support convergence efforts, such as creating research institutes or programs around a common theme, problem, or scientific challenge; hiring faculty in transdisciplinary clusters; and embedding support for convergence in the promotion and tenure process. Convergence efforts can also be informed by economic, social, and behavioral science and humanities research on establishing interdisciplinary cultures, supporting team-based science, and revising STEM education and training.

To accelerate convergence, experts, funding agencies, foundations, and other partners should identify key problems whose solution requires convergence approaches, the report recommends. Research institutions, funding agencies, foundations, and other partners should address barriers to convergence as they arise, and they should expand mechanisms for funding convergence efforts. Seed funding to catalyze collaborations

should be implemented or expanded. Leaders and practitioners who have fostered a convergence culture in their organizations and laboratories should develop partnerships with other institutions, helping to nurture their convergence efforts.

To most effectively achieve such goals and move beyond the current patchwork of convergence efforts, greater coordination will be needed, the report says. National coordination on convergence would provide a platform for agencies that support biomedical research, such as the National Institutes of Health, and those that support research in the physical sciences, such as the National Science Foundation and the U.S. Department of Energy, to identify opportunities for collaboration. The power of such cross-agency efforts is illustrated by the success of the Human Genome Project, a collaborative effort of NIH and DOE.

Many stakeholders can be involved in the national coordination needed to advance convergence, the report says. For example, associations and societies can undertake convening efforts to set goals. Foundations could serve catalytic roles for the community. Cross-agency working groups could coordinate policy development. All of these actors can play vision-setting roles in establishing new strategies to facilitate convergence.

More information: www.nap.edu/catalog.php?record_id=18722

Provided by National Academy of Sciences