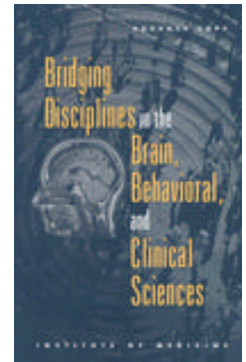


INSTITUTE OF MEDICINE

BRIDGING DISCIPLINES IN THE BRAIN, BEHAVIORAL, AND CLINICAL SCIENCES



To achieve the health goals of the 21st century, researchers from multiple disciplines must bridge their differences and together address the challenging problems that face us. The next generation of scientists must be prepared to integrate the advances of rapidly progressing fields. Although interdisciplinary work cannot replace the valuable contributions that have and will come from efforts within a single discipline, integrated approaches should be explored when scientific problems grow beyond what one discipline alone can solve. In response to the need for such approaches, an Institute of Medicine (IOM) committee was asked to examine the needs, obstacles, and strategies for interdisciplinary training in the brain, behavioral, and clinical sciences. The committee's report, *Bridging Disciplines in the Brain, Behavioral, and Clinical Sciences*, contains recommendations that delineate, enhance, and accelerate a process that is already reflected in many training and research programs. Although this report focuses on examples from brain and behavioral science, the principles presented may be broadly applicable in scientific research and training.

Barriers

Despite a recognized need for interdisciplinary research and a growing number of interdisciplinary training programs, the committee notes that barriers persist—disciplinary jargon and cultural differences among disciplines are serious problems; surveys show concerns among researchers about perceptions of interdisciplinary science as second-rate; and the duration and cost of education and increasing debt can be discouraging. Because publications and successful grants are essential for promotion and tenure, the concern that interdisciplinary research will reduce the likelihood of first-authorship and of funding presents an additional obstacle.

Funding agencies and universities can take measures to remove these barriers. Recommended actions for funding agencies include requiring commitments from university administration to support interdisciplinary efforts, share funding and core facilities, encourage legislation to expand loan repayment programs for investigators en-

Pain Research: The Value of an Interdisciplinary Approach

The study of pain is a prime example of a research problem that benefits from an interdisciplinary approach. Pain is one of the most frequent reasons for visits to the doctor and costs society greatly in terms of medical expenses and lost productivity. It is clinically manifested in many forms and influenced by stress, gender, genetics, and cultural background. Disciplinary research in pharmacology, physiology, neurochemistry, genetics, anthropology, and psychology has advanced our understanding of the phenomenon. Development of therapeutic approaches to the prevention, elimination, and control of pain requires the coordination of these efforts. Research is now integrating imaging technology, cellular electrophysiology, and neurochemistry to identify the neural substrates of pain; immunology and neuroscience to understand the influence of pain on health and disease; and social, psychological, and cultural effects on neurophysiology to elucidate the mechanisms of the perception of pain.

gaged in funded interdisciplinary research, and support peer review procedures that facilitate interdisciplinary research. The committee also recommends that universities review and revise appointment, promotion, and tenure policies to ensure that they do not impede interdisciplinary research and teaching; allocate appropriate credit for interdisciplinary efforts; and facilitate interaction among investigators through support for shared facilities.

Training Programs

Many opportunities for interdisciplinary training already exist at all career stages. Some of these are geared toward developing an interdisciplinary perspective, while others are easily adapted to that purpose. Scientific education at early career stages should be sufficiently broad to produce graduates who can understand essential components of other disciplines while receiving a solid grounding in one or more fields. This is the aim of most of the multitude of existing interdisciplinary predoctoral and postdoctoral training programs. Training mechanisms are diverse, ranging from integrated coursework to laboratory rotations. Some programs provide retreats where trainees can interact with experts in relevant fields so they can develop a network of contemporaries and senior scientists as a resource for interaction and collaboration throughout their career.

Translational research is an important subset of interdisciplinary research that translates information between the clinical setting and basic research laboratories. In recognition of the need to bridge the bench-to-bedside gap, many federally and privately funded programs support the training of clinician-scientists. Programs leading to MD/PhD degrees, such as the Medical Scientist Training Program (MSTP), can be effective in producing clinical researchers. The committee encourages PhD training and postdoctoral mentored career development awards for physicians, nurses, dentists, social workers, and other clinicians. Because exposing basic scientists to clinical problems can also enhance translational research, the committee further recommends that clinical experiences be provided in PhD programs.

Doctoral training in MSTP allows degrees outside traditional biomedical science, however, few universities implement this option, despite evidence that MD/PhD graduates with a PhD in the humanities are strong contributors to academic medicine. The committee recommends that MD/PhD programs in the social and behavioral sciences, as well as the biomedical sciences, be encouraged.

Finally, the financial burdens resulting from the administrative costs of interdisciplinary training programs can limit the motivation of universities, departments, and faculties to participate. Thus, training grant awards should be expanded to cover the full direct costs of implementation.

Career-Long Training Opportunities

Training opportunities need to be available at all stages of a scientist's career. Granting mechanisms specifically aimed at junior faculty and new investigators can provide an incentive to move toward interdisciplinary research projects. Training for those established in their

Interdisciplinary research is defined as a cooperative effort by a team of investigators, each expert in the use of different methods and concepts, who have joined in an organized program to attack a challenging problem.

Interdisciplinary training should produce researchers who are sufficiently broad to understand essential components of other disciplines and who are equipped to participate in or direct interdisciplinary research.

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careers can encourage scientists to learn new approaches or to obtain a different perspective in their research efforts. The committee recommends support for career development programs to encourage junior faculty and midcareer investigators in interdisciplinary research.

One innovative mechanism available through the National Institutes of Health (NIH) is the “Supplement to Promote Reentry into Biomedical and Behavioral Research Careers.” Principal Investigators on eligible NIH awards can submit an administrative supplement to support a reentering researcher on an effort directly related to the funded parent grant. The committee recognizes the potential for this type of mechanism to promote interdisciplinary research and recommends that funding agencies should establish a similar grant supplement program to foster interdisciplinary training and research.

Although midcareer training often occurs informally, several funding approaches provide additional opportunities. Career development awards are available through NIH and various foundations for established scientists to expand their scope of training. Sabbaticals, faculty development programs—including departmental seminars or formalized courses at a person’s home institution—meetings, and workshops provide informal training to senior investigators. Consortia and multi-institutional programs also provide opportunities for continued learning and far-reaching integration of research efforts in multiple disciplines. The committee recommends that funding mechanisms be provided for these types of opportunities.

A Multitude of Training Programs

The committee examined over 100 interdisciplinary predoctoral and postdoctoral training programs and the variety of mechanisms they use to promote interdisciplinary research. Most strive to provide trainees with grounding in a particular discipline while encouraging interdisciplinary interactions. Formal coursework is used to introduce trainees to many scientific fields and diverse methodological approaches to research questions. Journal clubs are often used to supplement didactic training. A key component of any training program is the laboratory research effort. Many programs require laboratory rotations to expose students to a range of faculty and experimental techniques. An additional goal of many of the interdisciplinary programs is to provide students with a forum in which to interact with experts in relevant fields, through summer courses, symposia and off-site meetings.

Strategies and Evaluation

Despite decades of discussion about the need to integrate disciplines, data to support the requirement for and effectiveness of the available mechanisms are scanty. To know whether interdisciplinary training promotes interdisciplinary research, it is necessary to have a way of identifying such research and training programs and a means of measuring their success in promoting these efforts. Thus, the committee recommends that NIH develop and implement mechanisms to identify and evaluate the outcomes of interdisciplinary training and research programs.

The committee encourages interdisciplinary training and research to solve problems resistant to the methods of a single discipline that require the simultaneous application of concepts and methods from several disciplines. Interdisciplinary research is flourishing in our institutions, despite the barriers. The question is how best to facilitate, direct, and evaluate its growth.

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For More Information . . .

Copies of *Bridging Disciplines in the Brain, Behavioral, and Clinical Sciences* are available for sale from the National Academy Press; call (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area), or visit the NAP home page at www.nap.edu. The full text of the report is available on line at books.nap.edu/catalog/9942.html.

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