Interdisciplinarity
PATHS TAKEN and NOT TAKEN

BY IRWIN FELLER

Increased emphasis on interdisciplinary approaches to research and graduate education is a common feature of academic strategic plans written since around 2000. This emphasis follows from the coupling of two propositions, one about the characteristics of academic research and the other about the hierarchy within America's higher-education system.

The first proposition is the widespread, albeit not unanimous, assessment by scientists, academic leaders, government and foundation officials, and industry leaders that "interdisciplinary thinking is rapidly becoming an integral feature of research" (National Academy of Science, 2005, *Facilitating Interdisciplinary Research*). This development is variously attributed to the changing structure of scientific knowledge, the fact that societal problems rarely fall within the domains of single disciplines, and the expressed needs and interests of students and employers.

The second proposition is that both established and aspiring research universities recognize that they operate within multiple competitive environments, in which their success at what Stephen Stigler has termed "intellectual competition" depends upon the importance, novelty, and currency of their ideas. Strategic planning focused on interdisciplinarity reflects the latter's heightened standing as a competitive strategy for enhancing institutions' performance, national rankings, and capacity to secure external funds.

But strategic commitment is not implementation, and progress towards interdisciplinarity has varied across universities. Four national studies over the course of a decade, which included site visits, interviews with university administrators and faculty members, and reviews of relevant documents at a cross-section of major research universities, all reveal that movement at some universi-

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ties has been rapid, at others slow, and at others blocked.

Two opening caveats: First, these are snapshots of strategies, events, and early outcomes, not conclusions about irreversible behaviors or predictions of inexorable long-term outcomes. Second, I am not arguing for (or against) current thrusts towards interdisciplinarity. Reservations about its intellectual force and organizational staying power clearly exist, as suggested by Abbott's characterization of the enthusiasm for cross-disciplinary work as a "perpetual hazy buzz."

The National Research Council's position on the matter is illustratively cautious. Its 2003 methodology guide recognizes "that scholarship and research in interdisciplinary fields has grown significantly since the last study" and says that, in consequence, the NRC will rank "acknowledged interdisciplinary fields, such as neuroscience, biomedical engineering and American Studies" and *list* emerging interdisciplinary fields—which will be added to the surveyed fields only after they have become established scholarly areas.

Paths Toward Interdisciplinarity

Four paths are discernible in the post-2000 implementation of strategic-planning commitments to interdisciplinary activities.

Capitalizing on Strengths

This first group of universities has found that recent national attention to interdisciplinarity has validated the institutions' past commitments and organizational arrangements supporting it. At these universities, faculty and administrators see interdisciplinarity "as part of the way things are done here." Having already having contributed to their academic distinction, this orientation is now seen as even more promising. As a result, these universities have increased their commitment by updating organizational arrangements and institutional policies or by adopting new ones that further support cross-disciplinary activities.

In this first group are institutions such as Carnegie-Mellon University, the Massachusetts Institute of Technology, and the University of Michigan. A commitment to interdisciplinarity has long been a distinctive feature of Carnegie-Mellon's strategic orientation. It was adopted several decades ago in recognition of the fact that with its small faculty, the university could not compete for national academic eminence with far larger universities in mainstream disciplines such as chemistry, electrical engineering, and psychology. Thus it is no surprise that in 2006, Carnegie-Mellon received a National Science Foundation award to establish an interdisciplinary Engineering Research Center, the third such entity there.

Strategic planning focused on interdisciplinarity reflects the latter's heightened standing as a competitive strategy.

At MIT, the commitment to interdisciplinarity reflects a belief that collaboration with researchers in fields other than one's own is an essential requirement for excellence—indeed, preeminence—in emerging fields of scientific inquiry. Institutional receptivity to interdisciplinarity also is reflected in MIT's establishment in 1998 of an Engineering Systems Division that can grant tenure and whose faculty have joint tenure-track appointments in the division and in traditional academic departments. This organizational arrangement is seen as supporting the "development of new interdisciplinary frameworks and methodologies" while enabling faculty to "remain keenly involved with their engineering, management, or social-science departments."

A similar orientation is observable at the University of Michigan, where institutional pride in its "willingness to tie together productive insights from several disciplines into crosscutting projects" is explicitly highlighted in a 2000 self-study prepared for institutional re-accreditation. Mindful of the potency both on and off campus of the rankings in the NRC's periodic *Research Doctorate Programs in the United States*, Michigan administrators have accepted that the university's emphasis on interdisciplinary research and graduate education may have cost it some standing. But they have continued to express confidence in what the institution has done, is doing, and plans to do. This stance contrasts with the one encountered at several other universities, where strategic-planning objectives have been expressed in terms of their advancing in the NRC rankings: move up X number of places, be a top-10 university, etc.

Changing Paths

A second group of universities is embarking confidently on a path towards interdisciplinarity after having in the past followed disciplinary paths towards academic distinction. They now view interdisciplinary research and graduate education as a better route for advancement. Accordingly, they are investing substantial resources and undertaking major internal transformations to shift direction. Duke University and the University of Southern California are examples of this redirection.

Duke's 2001 strategic plan, *Building on Excellence*, noted that, "while our modern research university was forged from an alliance of disciplines, with knowledge largely fostered within traditional departmental or school structures, recent decades have seen an accelerated

integration of knowledge across the sciences, social sciences, and humanities, in fields ranging from the biosciences to cultural studies. The mode of research that permits this integration of knowledge can be characterized, to a substantial degree, as multidisciplinary and interdisciplinary" (p. 16). This commitment resulted in a novel strategic-planning process: Instead of relying exclusively on plans percolating up through departments and colleges, as has been the case at many institutions, Duke also permitted faculty to independently propose new initiatives involving two or more colleges. Reinforcing this new orientation, in 2006 Duke announced a $1.3 billion, five-year set of strategic initiatives, in part directed at strengthening its investment in interdisciplinary programs.

USC's initiatives in its College of Letters, Arts, and Sciences likewise have had a strong interdisciplinary orientation, built on the strategy of recruiting senior faculty who have demonstrated a proclivity to collaborate with researchers in other disciplines. USC's attitude towards the 1995 NRC rankings also stands out. These rankings encompassed only 41 fields, mostly long-established mainstream disciplines. But USC's strategy has been based on Wayne Gretzky's admonition to skate to where the puck is going to be, not where it has been. USC's emphasis on newly emerging interdisciplinary fields is predicated on the belief that these fields will come to represent the frontiers of research and graduate education and that when they eventually are recognized as such, USC will emerge as a national leader.

Prominent also among the universities choosing to move along an interdisciplinarity path to eminence are the University of California, Santa Barbara and Arizona State University. But the two institutions represent two very different starting points. UC Santa Barbara's efforts embody Thomas Jefferson's observation, "Happy is the country which has no history." Newly emergent research universities begin with (relatively) fluid curricular and organizational arrangements; the emphasis they place on disciplinary and interdisciplinary modes of research and graduate education are less encumbered by disciplinary traditions than is the case at older universities. UC Santa Barbara's early commitment to an interdisciplinarity orientation in fields such as physics, geography, and materials science set it on a trajectory that today has spread across the campus. Arizona State, by contrast, has fundamentally changed direction with the arrival of a new president, Michael Crow, who has espoused the need for a basic restructuring of the organization and the content of academic research and graduate education, in order to promote interdisciplinarity.

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Making the Most of Modest Means

A third group of universities, starting from modest positions in the national rankings and with little prospect of competing head-to-head for national visibility or external funds with larger, more-established discipline-based departments, see themselves as having relatively little to lose and much to gain by shifting the relative disciplinary/interdisciplinary weights in their portfolio of research and graduate education. Accordingly, they have opted to move into emerging, interdisciplinary research areas and associated external-funding niches.

The University of Kansas is an example of this strategy. In 2003 it succeeded in having its Center for Environmentally Beneficial Catalysis designated as an NSF Engineering Research Center. This resulted from the central administration's strategy of selectively seeding a small number of interdisciplinary-research initiatives. Florida State University's "cluster-hiring" initiatives represent a similar strategy, including one cluster in experimental economics that brings together faculty in economics and political science.

Neither department ranked in the top two quality tiers in the 1995 NRC rankings. The implied strategy here is that supporting departmental collaboration in what is perceived to be a cutting-edge field is a more effective and rapid path to improved performance and institutional standing than having each department separately attempt to improve its reputation.

Staying Stuck

For a fourth group of top-ranked and aspiring universities, movement toward interdisciplinary initiatives has been impeded or blocked by administrative action and inaction. The language in the strategic plans of these universities differs little from that in the plans of the universities I've been discussing. These universities too have rearranged organizational boxes, created new positions, and publicized interdisciplinary initiatives or awards. However, they have proven themselves unwilling or unable to implement the changes in policies, cultures, or administrative officers required to advance very far along an interdisciplinary course.

Vignettes from site visits suggest that these barriers most frequently occur at the college level. At one upwardly aspiring institution, my visit coincided with a fruitless meeting of a lead faculty member, department head, and college dean about honoring the university's commitment to hire faculty with expertise in the research domain of a recently established NSF center.

The dean did not consider the research area to be within the mainstream of the department's discipline and refused to approve such hiring, placing renewal of the center's funding at risk.

At another major research university, a former dean was described by administrators as having made his college a "fortress." Faculty in the college were strongly advised to conduct their research within its disciplinary domains and not to fraternize with other academic units. Consequently, the college and university fared poorly in major competitions—until a new dean with a strong interdisciplinary orientation took office.

At yet another institution, funding proposals from an applied-science and engineering college were hampered during the external-review process by the absence of social scientists on its core research team, the consequence of a strictly defined disciplinary focus in the liberal-arts college in which the social-science departments resided.

The effect of these actions and behaviors has been to rupture the connection between, on one hand, the visions, objectives, and plans presented in central-administration documents and, on the other, the actual working environments of faculty and departments.

This rupture has yet another stultifying effect, one that probably contributes to the poor track record in major national competitions of selected universities in this fourth group. Absent what faculty perceived to be a genuine intellectual or administrative commitment to interdisciplinarity, periodic top-down efforts by university administrators to elicit faculty interest in pursuing major national awards carry with them a Willie Sutton aura ("Why do you rob banks, Willie?" "Because that's where the money is"). The institutional imperative is seen as obtaining money, not as advancing science or training graduate students—an approach that does not attract nationally competitive faculty.

Lack of faculty interest has been another source of institutional quiescence in implementing interdisciplinary strategic-planning proposals. This lack of interest is seen primarily in two settings. The first is where a discipline has coalesced around a paradigm that is seen by both by its practitioners and its potential collaborators as hegemonic. Several senior academic administrators mentioned economics as exhibiting this trait. They discussed the challenges of engaging economists in interdisciplinary projects and of finding scholars in other social sciences willing to work with them.

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The second setting is where individual faculty and departments have strong national reputations and ready, steady access to external funds. Central-administration strategic plans, even when accompanied by additional resources, may offer few incentives in such cases. This is why, in *Making Harvard Modern*, Morton Keller and Phyllis Keller expressed skepticism about the possibility of former Harvard President Rudenstine's interdisciplinary initiatives' taking hold: "It is no means clear that if faculty horses are enticed to gather at center-selected waterholes, they will drink deeply." And indeed, only the initiative in neurosciences seems to have garnered sustained faculty interest.

Accounting for Different Pathways

The list of barriers to interdisciplinary work is well known. Typical difficulties include assessing the quality of publications outside mainstream disciplines; apportioning credit for multi-author papers, especially when collaborators are from multiple disciplines or institutions; apportioning responsibility among different academic units for the initial financial or resource commitments needed to compete for major interdisciplinary funding; divvying up the indirect-cost allotments that may accompany such funds; determining who will control space and capital-intensive facilities; and agreeing on standards for recruiting and evaluating faculty with joint appointments.

But such lists tend to be both mechanical and static. They present barriers as a series of fixed off/on switches by which an institution is more or less hospitable to interdisciplinary initiatives. They simultaneously explain too much and too little. By themselves they cannot account fully for why some universities seem to be successfully moving towards interdisciplinarity while others are not. A more organic and historical perspective is needed to account for those differences. University representatives have cited the following three factors as affecting the pace of implementation.

The Status Quo

Oft described as "path dependence," once an entity is moving along a given path, future moves tend to stay along that same path. An illustration is Paul David's classic article on the economics of QWERTY: The keyboard arrangement of early typewriters (and now computers) has been locked in for decades, even though an alternative placement of the alphabet's letters would be more efficient. The same thing occurs in institutional cultures where shared values, understandings, and power relationships develop that determine the "costs" to faculty and administrators of crossing the boundaries of disciplines, departments, and colleges, whether or not those boundaries still make sense.

Strikingly, at several universities in the first and second groups above, ad-

ministrators and faculties pointed to past events perceived as having set their institutions on their current interdisciplinary paths. Michigan administrators and faculty frequently mentioned the immediate post-World-War-II period, when a set of distinguished social scientists collaborated to pursue the interdisciplinary line of survey-based research that led to the establishment of the Institute for Social Research in 1948. The unquestioned academic credentials of the individuals involved and their success in gaining major federal grants (at that time still a novel event on many campuses), legitimized an interdisciplinary approach that subsequently spread to other parts of the institution and continues to the present. At UC-Santa Barbara, the early leadership of engineering dean Robert Mehrabian in building interdisciplinary programs is still widely mentioned as having influenced the institution's receptivity to similar ventures.

The universities in the fourth group appear to be locked into the disciplinary commitments they made in the 1980s and early 1990s, often as a consequence of the "selective excellence" mantra characteristic of strategic planning in that period—a mantra many of today's senior faculty and administrators experienced. Consequently, movement in the direction of interdisciplinarity in this group is less consistent than for institutions historically more receptive to this approach.

Leadership

Institutions can abandon the status quo, however. Universities in the first three groups have indeed changed, and attempts at change are also visible in the fourth group. Indeed, interdisciplinarity can be initiated, championed, spearheaded, or facilitated at several places within a university. At a number of institutions I studied, entrepreneurial senior faculty formed partnerships with central administrators to overcome the inertia or resistance of deans and department heads to interdisciplinary engineering centers supported by NSF. University presidents such as Michael Crow at Arizona State, provosts such as Peter Lange at Duke and Jean-Lou Chameau when at Georgia Tech, and vice presidents for research such as Robert Barnhill when at the University of Kansas all have exercised such leadership. And although on some campuses the deans are the barriers to interdisciplinary activities, on others they have been leading advocates and agents of change. Joseph Auon, former dean of the College of Letters, Arts, and Sciences at the University of Southern California and currently president of Northeastern University, and Andrew Wachtel, dean of the graduate school at Northwestern University, are examples of such leadership.

Leadership also extends to replacing academic administrators who are not supportive of changed directions. Duke and Arizona State are examples of places where increasing institutional commitment to interdisciplinarity has involved the replacement of some deans—through retirement, routine turnover, or otherwise—to ensure compatibility between central administration and college priorities and behaviors. David Kirp's account in *Shakespeare, Einstein, and the Bottom Line* of the supportive environment for interdisciplinary activities at Michigan presents a clear contrast to some of my findings from site visits at other universities. Kirp writes: "Deans who undermine joint research ventures by insisting that faculty members run their grants through their home departments rather than through multidisciplinary institutions have been told to be better citizens or else pack their bags."

At other universities, senior administrators have acquiesced in or ignored such resistance by department heads or deans, thus vitiating institutional thrusts towards increased interdisciplinarity. These universities appear to be distributing a car's steering wheel, pedal, and brake among different drivers, each with a different view as to where the car should go and the speed at which it should move.

Resources

Interdisciplinarity initiatives are not without cost. They can require new faculty hires, support staff, space, and equipment. Even at universities where administrators and faculty members are strongly committed to new interdisciplinary research and degree programs, scarce resources often limit the heights to which interdisciplinary initiatives can grow. Faculty who accept extra course loads to develop and launch new seminars can do so for only a few semesters unless additional faculty are hired to teach their core courses. And access to the classrooms, laboratory space, and new equipment necessary for new interdepartmental or inter-college initiatives must compete with pre-existing claims on these resources.

Moreover, to the extent that interdisciplinary initiatives are funded by external sponsors or even institutional seed money, sustaining these initiatives when the awards end depends on a steady and rising flow of institutional funds. Like the often-cited experience of start-up firms, once the initial endowment is expended, fledgling interdisciplinary programs enter the (resource) valley of death, from which they may not exit.

Recent times have not been propitious for launching new initiatives, interdisciplinary or otherwise, at least for public research universities. The spate of strategic-planning initiatives in the plans written around 2000 coincided with a slowdown in the growth of general state appropriations, including outright reductions in some states. The result has been increased pressure on institutions to "protect the core"; few resources have been available for more than modest implementation of ambitious plans to introduce new interdisciplinary programs.

Although no systematic evidence exists on this point, gleanings from sources such as *The Chronicle of Higher Education, Inside Higher Education*, and *Science* suggest that private research universities, using unrestricted endowment funds and foundation awards, have been announcing new interdisciplinary programs at a much higher rate than have public universities.

Implications

The consequences of the differences in the rate and extent to which universi-

ties have implemented interdisciplinary initiatives have yet to be fully felt across the U.S. research-university system. And indeed, observed differences to date may not necessarily predict the future.

But they *may* imply several things. First, to the extent that interdisciplinarity does constitute the royal road towards significant scientific advances and stronger educational programs (and concurrently toward the external resources needed for these activities), institutions that move faster and further along this road will improve in performance and advance in standing relative to those unwilling or unable to overcome internal barriers to interdisciplinary initiatives (The inverse of this statement may also be true: If interdisciplinarity is not the royal road, institutions that move rapidly along it will be traveling faster in the wrong direction.)

Second: If projections about the heightened scientific and professional importance of interdisciplinary approaches to research and graduate education are correct, the more rapid pace of implementation in private than in public research universities implies that the relative importance of the privates as the source of new knowledge and locus of training for the best graduate students will increase. This would add to what Roger Geiger and others have presented as a widening gap in the resource base, administrative nimbleness, and scholarly performance of the two sectors.

Third, universities whose efforts to foster interdisciplinarity have not amounted to much to date and who genuinely see this orientation as a desirable or necessary path to improved institutional performance may have to initiate more fundamental changes in their cultures, organizations, budget arrangements, and administrators than they have to date. The unmet need at these institutions appears to be a firm and clear central-administration commitment to interdisciplinarity. This includes the willingness of institutional leaders, typically a provost or vice president for research, to assure faculty engaged in interdisciplinarity initiatives, as I have said elsewhere, that "their activities are consistent with and supportive of institutional objectives even if these activities encounter manifest or subtle opposition from departmental or college administrators."

Competition is likely to be the major propellant as universities pursue interdisciplinary modes of research and graduate education. If interdisciplinarity is indeed the path to a bright future, competition will reward those institutions that rapidly adapt their programs, policies, and cultures to accommodate this trend in science, student interest, and sponsors' largesse—and it will penalize those that do not.

Suggested Additional Readings

- Andrew Abbott (2002). "The Disciplines and the Future" in *The Future of the City of Intellect*, edited by Steven Brint. (Palo Alto, CA: Stanford University Press), 205–230.
- Irwin Feller (2002). "New Organizations, Old Cultures: Strategy and Implementation of Interdisciplinary Programs." *Research Evaluation,* 11: 109-116.
- Roger Geiger (2004). *Knowledge & Money*. (Stanford, CA: Stanford University Press).
- National Research Council (2005). *Facilitating Interdisciplinary Research.* (Washington, DC: National Academy Press).
- Peter Weingart and Nico Stehr, editors (2000). *Practising Interdisciplinarity* (Toronto, Canada: University of Toronto Press).