

Academic Departments and Related Organizational Barriers to Interdisciplinary Research

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This qualitative case study examines the disincentives faculty members encountered in working toward interdisciplinary research centers. The barriers stem from the organizational structure of most U.S. universities. Resources such as overall budgets and returned overhead are distributed to departments, which in turn reward faculty only for efforts within the discipline. While research centers and institutes outside the departmental structure have demonstrated success, we focus on an understudied aspect: the experiences of faculty working within traditional departments to build interdisciplinary efforts. We provide specific examples of the institutional barriers faculty members face, as well as suggestions for removing barriers.

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Introduction

Many of the important questions facing researchers today are interdisciplinary in nature (Metzger & Zare, 1999; Payton & Zoback, 2007; Rhoten & Parker, 2004). While many faculty members have found research pursuits outside their home disciplines to be professionally rewarding (Edwards, 1999), some have found such interdisciplinary activities daunting and burdened with disincentives (Committee on Facilitating Interdisciplinary Research, 2005). Particularly in the United States (Abbott, 2001, 2002), many of the disincentives to interdisciplinary research have been traced to the organizational structure of academic departments (Bozeman & Boardman, 2003).

Academic departments typically encourage disciplinary research over problem-based interdisciplinary research (Wolverton, Gmelch, & Sorenson, 1998). The close alignment between departments and disciplines has caused some to argue that interdisciplinary research is better served through university research centers outside the departmental structure (Dressel & Reichard, 1970; Sa, 2008). Over the past forty years, the number of research centers and institutes on U.S. university campuses has grown tremendously (Bozeman & Boardman, 2003). Much of the current literature concerning university research centers and institutes focuses on those already in operation (Mallon, 2006; Stokols, Hall, Taylor, & Moser, 2008) as well as the perceptions and experiences of university administrators, research center directors, and center-affiliated faculty members (Boardman & Bozeman, 2007; Boardman & Ponomariov, 2007; Bozeman & Boardman, 2003; Bunton & Mallon, 2007; Corley, 2005; Etzkowitz & Kemelgor, 1998; Stahler & Tash, 1994). Despite a wealth of literature dealing with collaboration across functional areas, little attention has been paid to the struggles individual faculty members encounter as they seek to extend beyond traditional disciplinary and departmental boundaries to *create* such interdisciplinary research centers.

In a recent survey of U.S. faculty members, 92% of respondents said their institutions' administrators encourage interdisciplinary research collaboration. However, nearly half of those surveyed, 48%, admitted to experiencing "institutional or departmental pressure for at least one collaborator to focus effort elsewhere" (Borrego & Creamer, 2007, pp. 363-364). Such an inconsistent research message from administrators to faculty members underscores the difficulties many faculty members encounter as they engage in research activities across disciplines. The

purpose of this study is to provide concrete examples of how organizational structures create disincentives to university faculty members moving outside disciplinary boundaries to expand ongoing interdisciplinary research activities into interdisciplinary research centers. Such examples should be useful as institutional and departmental administrators seek to identify, understand, and eliminate barriers that faculty members confront in the establishment of interdisciplinary research centers. Specifically, our research question is: what challenges do faculty members face as they seek to create interdisciplinary research centers, and how does the current academic department structure hinder their success? We use the barriers identified in the 2005 U.S. National Academies' report *Facilitating Interdisciplinary Research* as a starting point (see Table 1) to frame detailed descriptions of the experiences of individual faculty members aspiring to interdisciplinary research.

Table 1
Institutional Barriers to Interdisciplinary Research

Category	Description
Limited Resources	Diversion of time and resources from existing departmental activities
Academic Reward System	Departmental control of faculty hiring, promotion, and tenure
Different Academic Cultures	Departmental customs, shared values, understandings and relationships
Program Evaluation	Relationship between program assessment and resource allocation
Different Departmental Policies and Procedures	Allocation of indirect-cost recovery funds; organizing research and teaching; allocation of credit for multi-author papers; control of space; agreement on standards for recruiting and evaluating faculty with joint appointments
Lengthy Startup Times	Time needed to arrange equipment, staffing or infrastructure, and understand language and culture of collaborators
Decentralized Budget Strategies	Central administrations' scarce fiscal resources for initiating or sustaining interdisciplinary research programs; departments' potential reluctance to contribute resources for activities not seen as directly beneficial

Note: Constructed from direct quotes of Chapter 5 of *Facilitating Interdisciplinary Research*.

For researchers who have experienced these obstacles, Table 1 is clear, but to others, these descriptions mean little in the absence of specific examples. To address these concerns, we followed two interdisciplinary research teams comprised of tenure-track faculty members from several disciplines and departments at one large U.S. research university. This work complements existing research on successful interdisciplinary researchers and research centers, as it explores the challenges of faculty members transitioning from traditional disciplinary departments to interdisciplinary research centers.

Literature Review

Academic departments have been identified as a major factor in the success of the modern university in the United States (Dressel & Reichard, 1970; Edwards, 1999; Walvoord, 2000). Their prominence within the majority of U.S. institutions of higher education is both unquestioned (Eckel, 1998; Lee, 2004) and reinforced by disciplinary professional communities that extend well beyond the institution (Clark, 1984). To better understand the varying perceptions and potential for change in organizations such as universities, Bolman and Deal (2003) provide a four-frame model. Viewing organizations from all four frames (structural, human resources, political, and symbolic) rather than only one allows for a “greater appreciation and deeper understanding of organizations” (p. 15). Applying Bolman and Deal’s (2003) framework to the academic department elucidates its entrenched position and preeminence within the university structure of most U.S. academic institutions.

Structural Frame

Within the structural frame an organization is viewed as a machine—a series of rules and policies (Bolman & Deal, 2003). The organizational structure of academic departments within institutions of higher education was not developed for its administrative efficiency but rather for its ability to promote disciplinary knowledge within a community of scholars (Edwards, 1999), a solution to the challenges of increasing enrollment and faculty member specialization (Andersen, 1968). Academic departments have been a major organizational unit of institutions of higher education within the United States for nearly two centuries (Dressel & Reichard, 1970). Departments were seen as a means of offering flexibility to students and of organizing professors into “specialized instructional units” (p. 391). Such a structure has produced a culture and policies that encourage separation through “the building and nurturing of inviolable cells” (Seymour, 1995, p. 25). In spite of the criticism over lack of efficiency, the department is still considered a crucial component of the university structure (Walvoord,

2000) as well as a vital connection between broad academic disciplines and the university (Eckel, 1998; Lee, 2004).

In recent decades, institutions of higher education have attempted various means of reform both on the institutional and the individual levels in response to changes in the higher education environment such as increased economic pressures, collaboration opportunities, and competition (Walvoord, 2000). At the institution level, research universities are focusing on undergraduate students and learning (Murray & Summerlee, 2007). At the individual level, reformers have sought to redefine incentive systems for professors (Edwards, 1999). Given the entrenched position of academic departments and their preeminence within the university structure, it is no surprise that efforts to change their standing have been met with resistance.

One possible explanation for this resistance is the historical success of academic departments. As noted above, the success and reputation of a specific academic institution has been largely tied to that of its academic departments. Over time, the success of an organization can be attributed to its organizational structure, which can produce a pattern of persistence (Audia, Locke, & Smith, 2000), thus limiting adaptability of the organization to its changing environment (Hannan & Freeman, 1977). This tendency, known as the “paradox of success”, occurs as organizations fail to adapt to changing environments and fall into a “pattern of dysfunctional persistence” (Audia, et al., 2000, p. 850). The paradox occurs when an organization loses the ability to change strategies when a previously effective strategy ceases to work. Often such a paradox is difficult to recognize because the procedures that brought about previous success become obstacles in the face of a dynamic external environment.

In recent years, higher education has developed an entrepreneurial as well as an interdisciplinary dimension at both the institutional and individual faculty levels (Clark, 2004; Etzkowitz, 2001). While these are significant changes at both the institutional and individual levels, they have had little effect on the “deep structure” (Gersick, 1991) of institutions of higher education: the academic department.

The “deep structure” of an organization is related to the “set of fundamental ‘choices’ a system has made of (1) the basic parts into which its units will be organized and (2) the basic activity patterns that will maintain its existence” (Gersick, 1991, p. 13). It has been compared to the rules and playing field design in sports. For example, in soccer there is a fundamental difference between changing the height of the goals and removing them altogether. “[T]he first kind of change leaves the game’s deep structure intact. The second dismantles it” (p. 19). Thus a simple reordering of disciplines into new departments (Faricy, 1974) (i.e. changing

the size or location of the goals) could prove useful on some levels, but the basic rules of the current academic game would remain unaltered. The most extreme response to modifying the deep structure of the academic institution would be to “abolish all departmental lines” entirely (Edwards, 1999, p. 22). Such a radical change to the deep structure of higher education is clearly an example of removing the goals altogether. Regardless of how academic reform movements affect academic departments, it is clear that meaningful change is unlikely to occur without modifying this element of the deep structure of the organization (Burke, 2002).

The practice of departmentalizing emerging academic interdisciplinary fields is an example of institutions of higher education engaging in patterns of persistence. Institutions of higher education fixated with departmentalization have created new academic disciplines, such as biophysics and agribusiness, which naturally are housed in existing or new academic departments (Edwards, 1999, p. 19). For such new interdisciplinary programs departmental status provides legitimacy to the new discipline yet “departmental status is a hazard because the objectives of such programs call for collaborating with other departments rather than competing with them” for resources (Alpert, 1985, p. 263).

An alternative response to the increased emphasis on interdisciplinary research has been the creation of research centers and institutes, whereby faculty members have an opportunity to maintain departmental tenure homes while participating in an organizational mechanism that encourages networking and collaboration across disciplines (Sá, 2008). Such a system appears to be beneficial to affiliated researchers (Bozeman & Boardman, 2003). Working from the assumption that interdisciplinary research centers and institutes are a desirable solution (at least in the interim) to many of the institutional barriers to interdisciplinary research, important questions remain as to how these centers form from the perspective of faculty members in disciplinary departments seeking to transition to interdisciplinary research and eventually research centers.

Human Resource Frame

The human resource frame portrays organizations as collections of relationships. As in a familial unit, individuals within an organization work together to satisfy both particular and collective needs (Bolman & Deal, 2003). While the academic department is relatively new compared to other academic traditions, it has achieved a level of autonomy which can be both beneficial and detrimental to the institution at large. The autonomy of departments is mirrored by the individualistic nature of most faculty members (Cross, 1998), which allows the faculty member the freedom to seek new knowledge. In turn, this research enhances the reputation of the

department and, by extension, the institution (Dressel & Reichard, 1970). However, this autonomy creates an environment in which each department has great latitude in determining how it will “meet the institution’s larger mission” (Lee, 2004, p. 607). Particularly when they are aligned to traditional disciplines, department norms are defined by those of the discipline rather than the institution (Clark, 1984). In this way, academic departments have been described as “tribes” seeking to “defend their own patches of intellectual ground by employing a variety of devices geared to the exclusion of illegal immigrants” (Becher, 1989, p. 24).

Within most institutions of higher education, faculty hiring, promotion, and tenure decisions are controlled by departments. Such a structure allows for departments to regulate faculty behavior to a much greater degree than they could if human resource decisions were centralized within university administration. Departmental power over human resource decisions creates a problem for interdisciplinarity. While many empirical studies differ concerning the effect interdisciplinary research has on tenure decisions (Boardman & Bozeman, 2007; Bunton & Mallon, 2007; Serow, 2000; Stahler & Tash, 1994), the perception remains that untenured faculty members who engage in interdisciplinary research will be punished by their departments for venturing beyond their home disciplines (Rhoten, 2004). The independence within the academic structure has made the department “a potent force, both in determining the structure of the university and in hampering the attempts of the university to improve its effectiveness and adapt to changing social and economic requirements” (Dressel & Reichard, 1970, p. 387).

Political Frame

The political frame views organizations as a jungle, or a contest with winners and losers (Bolman & Deal, 2003). As discussed earlier, the department/discipline relationship is significant in that it allows established scholars within the discipline, such as journal editors, to determine “what work is considered good and what work is unimportant” (Cole, 1983, pp. 137-138). From this perspective, the academic department shapes much of the discourse related to interdisciplinarity and any potential changes within the larger organizational context.

An example of the importance of the political frame for organizations is the traditional view of the academic reward system. Ostensibly the reward system for faculty members is designed to reward the accomplishments of the individual over the accomplishments of the team. Yet, as described above and expanded below, interdisciplinary work often addresses questions far beyond the capacity of one person to confront adequately (particularly in the natural sciences and engineering). With this emphasis

on the individual it is little wonder why teaming within academia, let alone across academic departments, can be difficult.

Symbolic Frame

The symbolic frame highlights organizations as instruments of meaning creation (Bolman & Deal, 2003). The shared meaning within an academic discipline is often conveyed through a unique disciplinary culture (Reich & Reich, 2006). From degree programs to the tenure process the academic department is where myths and customs are perpetuated and reinforced. Language is the primary mechanism used to construct understanding, consensus, and ultimately knowledge (Berger & Luckmann, 1966). The metaphors of home or community are often used to when discussing academic disciplines and departments. Such metaphors are significant in that they frame our understanding of not only the function of but also the importance of academic departments. The symbolic frame highlights the difficulties many scholars face in attempting to participate in interdisciplinary activities because such undertakings run counter to the entrenched norms and values of academic departments.

Method

Qualitative Case Study Methodology

The guiding methodology of this investigation is descriptive case study, which is focused on explanation rather than hypothesis testing (Merriam, 1988). It is particularly appropriate when several variables interact with the context in ways that make them difficult to isolate (Merriam, 1988; Stake, 1995; Yin, 2009). Qualitative case study research is the study of a phenomenon in context to evaluate cause and effect as well as influences over time (Merriam, 1988). The philosophical assumption underpinning this qualitative approach is that there are multiple realities based on how individuals make meaning of their environment (Crotty, 2003). For example, there may not be a single “truth” of how and under what circumstances a particular policy is enforced. In this study, we are concerned with the reality experienced by faculty members pursuing interdisciplinary research.

Setting

Each institution will encounter barriers to interdisciplinary research to varying degrees, so this description of the institutional context is included to assist readers in judging transferability to other institutions (Lincoln & Guba, 1985). This study was set at a large public research university on the east coast of the United States. The university strategic plan¹ states that

the institution has “a strong commitment to inter- and multidisciplinary approaches” and encourages faculty members to “creat[e] innovative multidisciplinary research and teaching opportunities.” As such, the university seeks to “develop interdisciplinary research and graduate programs, including joint departmental appointments, to foster collaboration and provide unique opportunities for students.” Throughout the strategic plan, faculty members are encouraged to seek “innovative multidisciplinary funding” opportunities. The university currently has three interdisciplinary research institutes which focus on (1) life sciences, (2) sciences and engineering, and (3) social sciences and humanities. Of interest to this study, the directors of these institutes report directly to the university President rather than to the Vice President for Research.

Participants

Within this context, two faculty teams were competitively awarded internal funding from the university’s Office of the Vice President for Research which bought faculty members out of departmental teaching responsibilities. The goal was to win external financial support for the establishment of new interdisciplinary research centers. The two teams consisted of tenured and untenured faculty members with varying degrees of experience with funded research and interdisciplinary work.

The first team, Team A, comprised three faculty members, plus two administrative staff who participated in all team meetings. Team A had been together for three years and had been awarded a large grant for research and graduate training which was in its final year when data was collected for the present study. The second team, Team B, consisted of six members and originally formed two years prior to this study, for the purpose of teaching an interdisciplinary project course. At the time of this study they had begun submitting proposals for research funding, in some cases based on prior course project ideas. The faculty participants in both teams held tenure-track positions within eight different departments and six different colleges across campus: Agriculture, Architecture, Business, Engineering, Science, and Veterinary Medicine. Team A faculty members were all tenured full professors, while Team B included untenured assistant and tenured associate and full professors. Given the delicate political climate, we focused this exploratory study on faculty team members without interviewing any administrators, as the simple act of describing selection procedures would reveal information participants wanted to keep

¹ This citation has been withheld throughout to ensure the anonymity of the institution under study. The strategic plan of this institution was published in 2004.

confidential (such as their level of involvement in interdisciplinary activities). The faculty perspective is critical for understanding this problem, although our results suggest that future studies focusing on the viewpoint of administrators would be valuable.

Data Collection

We observed weekly team meetings as well as coordinated visits to three campus research centers. This analysis focuses on observations from August 2007 to December 2007, but data collection continued through December 2008 for both teams. We took observational field notes, supplemented by audio recordings which were selectively transcribed. The data collection for this study was approved through human subjects (IRB) review, and the participants signed informed consent forms. Each participant was assigned a pseudonym to ensure anonymity.

Data Analysis

In contrast to academic disciplines and the organizational structures within higher education, interdisciplinarity is not well theorized (despite extensive literature) (Spelt, Biemans, Tobi, Luning, & Mulder, 2009). We set out to study the process through which faculty members in traditional disciplines transition to interdisciplinary team research, which requires all three bodies of literature. Because case study research is characterized by simultaneous data collection and preliminary analysis, it was not until a few weeks into observations that the theme of obstacles emerged as a strong factor. Then, the framework from *Facilitating Interdisciplinary Research* (Committee on Facilitating Interdisciplinary Research, 2005) (Table 1) was applied as an initial coding scheme of barriers to interdisciplinary research previously identified by experts. Thus, the contribution of this work is not the listing of specific obstacles, but rather theorizing exactly how entrenched organizational structures based on traditional disciplines prevent the development of interdisciplinary research. It is also an empirical validation of the framework, complete with concrete examples.

As we applied this initial coding scheme, it became clear that some of the barriers would not be represented in our study of faculty teams, while others were too broad and lacked clarity. The coding scheme was then refined and clarified through the axial coding phase of constant comparative analysis (Strauss & Corbin, 1998). During this process of uniting, restructuring, recoding, and redefining data and codes, many of the original codes were combined while others were eliminated. For example, the *Academic Reward System* and the *Different Institutional Cultures* were merged into one code because the autonomy of the individual academic departments is a major reason for the different cultures. Such differences

between departments were most evident within our dataset in the way each department rewarded faculty member activities.

To ensure the validity of the findings, we triangulated multiple investigators' perspectives in the data collection and data analysis phases, shared a draft of this manuscript with participants to confirm the results and interpretation, continued our observations for at least 18 months for each team, conducted a cross-case analysis of the two different teams, and provided a detailed description of the context to assist readers in judging transferability to similar contexts (Lincoln & Guba, 1985; Merriam, 1988).

Results

Academic Reward System

Faculty hiring, promotion, and tenure decisions are generally controlled by departments. Departments are responsible for many of the “fundamental services of a university (teaching, research, and service)” (Eckel, 1998, p. 27). Inasmuch as interdisciplinary activities do not directly deliver these essential operations, “faculty often receive credit only for the teaching and research actually performed in their department” (Committee on Facilitating Interdisciplinary Research, 2005, p. 88). Several of the participants in this study confirmed this when they explained that if they wanted to participate in interdisciplinary activities they had to do so “as [an] overload” or “on the side”. One individual in our study participated in interdisciplinary team activities without the knowledge of his department head, stating that the department was “not always on board” with such interdisciplinary activities.

Moreover, an untenured faculty member in Team B was frequently counseled by team members to participate only in activities for which she would get “credit for tenure” (i.e., those in her discipline for which she would serve as the primary investigator); all other team activities should be delayed until after tenure. While scholars differ concerning the effect of interdisciplinary research on tenure decisions (Alpert, 1985; Boardman & Bozeman, 2007; Bunton & Mallon, 2007; Serow, 2000; Stahler & Tash, 1994), the perception remains that untenured faculty members will be “punished” for venturing beyond their home disciplines (Rhoten, 2004), and this perception limited the participation of at least one faculty member in our study.

Credit for Multi-Authored Papers, Proposals, and Other Writing

The credit faculty members receive for multi-authored papers and research proposals is also complicated by the organizational structure of academic institutions, which rewards the accomplishments of the

the individual over those of the team. Traditionally, the academic promotion process has valued individual over collaborative accomplishments. Such an approach “leads to competition for resources, dampens a natural desire to collaborate, and discourages true team dynamics among colleagues” (Frost & Gillespie, 1998, p. 12). In our study we identified three perspectives for allocating multi-author credit for interdisciplinary projects.

The *departmental perspective* maintains that unless a faculty member is the first author on a publication, he or she will receive no credit from the department towards promotion and tenure. This perspective was expressed by a member of Team A in reference to multi-author publications: “that’s the downside of interdisciplinary work. If you’re not the first author it’s like ‘what part of this did you do?’” The second perspective on multi-authorship we call the *team perspective*, which acknowledges that individual team members must be successful within their specific academic departments if the team is to be successful. As such, individuals with the team perspective use multi-author credit as a means of helping a specific team member “get a win”. This was particularly true for team members in need of credit within their departments or for tenure. For example, the members of Team B submitted a grant proposal with an untenured faculty member as the primary investigator (PI). While each team member expected to share equal responsibility for the proposal, this individual was highlighted as the PI in an effort to advance his/her career, since all others on this proposal were already tenured. The final perspective, *interdisciplinary perspective*, was explained by a research center director as a specific individual’s contribution to a project. “You may not be the PI on a project, and you might not be the first author on a publication, but what have you done to contribute?” The center director acknowledged that such an attitude runs counter to “some of the beloved tenets of academic research” yet is conducive to interdisciplinary research and what this center director referred to as “team science” by prioritizing project rather than individual success.

Joint Appointments

On the surface, joint appointments appear to surmount many of these barriers; however, they are often inherently burdened by their structure. Within institutions of higher education there is often little “agreement on standards for recruiting and evaluating faculty members with joint appointments” (Committee on Facilitating Interdisciplinary Research, 2005, p. 90). As such, a jointly appointed faculty member could end up serving two masters while pleasing neither. A faculty member with a joint appointment could also be caught between two departments competing for resources. Under such circumstances, the success of an individual faculty

member can lie in opposition to the success of the contending departments.

For example, an untenured, jointly appointed faculty member in Team B was unable to submit a grant proposal for funding from a federal agency before the deadline due to disagreement between two departments, even though the paperwork was begun several days in advance of the deadline. The head of one of the academic units refused to sign the necessary forms because there was confusion as to the amount of credit and overhead each of the departments and an interdisciplinary research center (which supplied seed funding for preliminary results) would receive. In this instance, the department head and other administrative staff misunderstood the form and could not be convinced they would receive the proper amount of overhead from the proposal in question. The faculty member later expressed frustration with the unenviable position of being “in the middle” of two entities battling over overhead. This faculty member struggled to understand how his/her grant proposal was derailed when she stated “purpose [of his/her joint appointment was] to build collaboration among [these two] entities”.

This experience highlighted for Team B the difficulties they might face in the future. The possibility of one of the team’s grant proposals being delayed because of administrative infighting was a matter of pressing concern. While the signature paperwork for a single-investigator proposal might take a full day, the team scheduled a full month to obtain the required signatures for their next proposal. Also in response to this experience, Team B requested a meeting with university administrators about the institutional policies and forms for the submission of grant proposals so that they could mitigate the possibility of a future team proposal being delayed over departmental wrangling. While the meeting was useful for the group, Team B remained skeptical of the institution’s reporting system as well as administrators’ future interpretations of collaboration data.

Much of this latent cynicism could be traced to previous negative experiences team members had with institutional reporting systems. Several other team members had been adversely affected by institutional and departmental administrators’ inability to evaluate information generated from the reporting system. In frustration, one team member recounted a “maddening” experience of working for over seven years to convince a department head to allow involvement (as co-PI) with a large funded research project. At the time, the institutional reporting system only listed PIs. The matter escalated further when this faculty member discussed the issue with the department head: “My department head was getting the [overhead from the grant] but didn’t believe me” because of the limitations of the reporting system. Based on this and previous experiences, Team B began to draft overhead agreements and other related paperwork months

in advance of future proposals.

Overhead

The financial dependence of departments on returned overhead from funded research is a significant institutional barrier to the success of interdisciplinary research. As one administrator within the Office of Research stated, at this institution, “most department operations are funded out of returned overhead”. Such dependence creates tension between deans and department heads over just where the overhead should be returned. As was seen in the example above, concerning joint appointments, contention over returned overhead has the capacity to doom research proposals before they even leave the university. One participant likened the deans and department heads to “sharks in the water” when it came to dismantling a research proposal to increase departments’ “cut of the money”. Administrators likely feel extreme pressure to demonstrate success and accountability through external funding and associated overhead. Thus, we believe the institution’s reliance on returned overhead to fund basic operations is a major cause of many of these institutional barriers. The academic department achieves a level of autonomy through the accumulation of returned overhead from funded research. In turn, returned overhead “enhances the autonomy and power of departments” (Walvoord, 2000, p. 35). While increased independence and strength of academic departments has the potential to enhance institutional prestige, these same characteristics serve to hinder institutional collaborative research goals.

Lengthy Startup Time and Different Institutional Cultures

An important aspect of interdisciplinary research is the integration of disciplinary knowledge (Repko, 2008), yet differing views of what constitutes knowledge as well as diffuse perspectives of interdisciplinarity (Lattuca & Knight, 2010; Moran, 2002) can be challenging. Interdisciplinary teams must not only overcome their own disciplinary biases but they must create common ground, or “a basis for collaborative communication” (Repko, 2008, p. 272) in order to produce a shared culture with their multi-disciplinary collaborators. Common ground between individuals from disparate academic disciplines is more difficult to create when there are large “epistemological differences between disciplines” (p. 274)

Discipline-specific language has been cited as one reason why interdisciplinary research often has a lengthy startup time (Caruso & Rhoten, 2001). In addition to faculty members from different disciplines learning each others’ disciplinary language and culture, there is a need for such groups to receive administrative support and facilities in which to

work. Unfortunately, the timeline for tenure and funded research projects do not take such activities into account (Committee on Facilitating Interdisciplinary Research, 2005, p. 91; Payton & Zoback, 2007; Pfirman, Collins, Lowes, & Michaels, 2005). Another possible explanation for the lengthy start up time with interdisciplinary research is the lack of a clear evaluation structure that is traditionally found in disciplinary research.

Throughout this study there was a tension between the research teams and the university's Office of Research funding coordinator concerning short-term funding goals and the expected timeline for achieving long-term center goals. The funding coordinator focused on the ultimate goal of research centers while providing little guidance on expected milestones and timelines. Furthermore the coordinator encouraged the team to submit as many proposals to funding agencies as possible regardless of topic area, stating that funded research was ultimately a "numbers game". Without clear expectations, Team B, who had been together as a research team a shorter period of time than Team A, spent weeks trying to understand what their goals and expectations were.

Space Allocation

Due to the interdisciplinary nature of these teams, members were physically located in numerous buildings across campus. The barrier of space increasingly became an issue as the teams met together more frequently. While use of a conference room in the Office of Research facilities in the off-campus corporate research park was offered, both teams quickly dismissed this option as too inconvenient. Team A was able to meet in an office on campus that had been designated for their ongoing interdisciplinary grant. Several times, Team A discussed the benefit of a dedicated space where the team could "be physically located in one place". Such discussions led to the team looking at office space both on and off campus as a means of finding common space to interact more frequently.

Prior to this study, the members of Team B taught an interdisciplinary course and experienced difficulties locating shared space. Throughout the observation period, Team B identified one of "their biggest barrier[s]" to interdisciplinary as "finding a place to work together". Without identifiable space, the team tried several meeting rooms across campus, using a team member's office and a department's conference room before identifying a location they could call their own. Not surprisingly, throughout the study Team B was much more vocal and persistent about the need to identify and obtain shared space. One participant stated that the opinion that shared space was "potentially the lynchpin" to successful interdisciplinary research. For Team B, the issue of shared space was more about the ability to leave team artifacts and "keep stuff on the walls" than the regular meeting location.

This may also have been motivated by the nature of their prior interactions teaching an interdisciplinary project course that was plagued with similar problems. Due to the nature of their work (student projects and associated prototypes), Team B focused more on physical artifacts than Team A.

Decentralized Budget Strategies and Limited Resources

From the institution's perspective much of the budget is earmarked for facilities, salaries and other instructional costs. Such inflexibility within the central budget of many institutions of higher education can leave seemingly extraneous activities such as interdisciplinary research unfunded (Committee on Facilitating Interdisciplinary Research, 2005). For example, members of Team B desired to host an academic conference in their interdisciplinary research area. The team members discussed who would support the conference financially. After some appeals to administrators, it became clear to at least one of the team members that the deans and departments heads were "not sympathetic to offering money" for such a project. One of the team members reported that as quickly as one researcher brought it up with his or her dean "it was shot down".

Limited institutional resources for new and existing interdisciplinary programs not only force such programs to survive on the margins of the institution but also demonstrate "an inevitable devaluation of the faculty member's work in such programs" (Edwards, 1999, p. 27). It becomes difficult to imagine how institutions of higher education with goals of attracting large interdisciplinary research funding can do so with a decentralized budget strategy which emphasizes the academic departments over the institution at large.

Discussion and Conclusion

Institutional barriers to interdisciplinary research are largely manifestations of the constraints of the current departmental organizational structure and accompanying decentralized budgets. Academic departments, schools, and colleges have come to rely on returned overhead to augment their operating budgets and ensure their independence from upper-level administration. This reliance on returned overhead trickles down to faculty members in the form of emphasis on contributions to the department and discipline. Often, teaching only in the department and publishing in the discipline count toward promotion and tenure, and pressure for external funding rises every year. Many large research grants are now interdisciplinary in nature (Committee on Facilitating Interdisciplinary Research, 2005), compelling faculty members to collaborate across disciplines. However, departments are reluctant to share returned overhead across multiple units and encourage PIs to take individual credit for group

efforts. Newer faculty members are often discouraged altogether from engaging in interdisciplinary activities too early in their academic careers, which may also be the underlying reason that Team A's full professors did not experience as many of the barriers as Team B's junior faculty. From the perspective of each of Bolman and Deal's (2003) organizational frames, the departmental system obstructs the type of collaboration and trust necessary for sustained quality interdisciplinary work, which is foundational to interdisciplinary research centers.

Given the many disincentives, it is surprising how much quality interdisciplinary work is actually produced. The growing number of problem-based interdisciplinary research projects is a positive sign that some researchers have found creative ways to overcome (or at least live with) the barriers described in this paper. Success is likely when strategic planning is employed to identify interdisciplinary research priority areas (e.g. energy, health) and direct resources such as seed funding, space, and some measure of recognition and stability through institutes. To some extent, these priority areas are identified based on existing strengths represented among the faculty. But to what extent can faculty members, with their own individual research interests, influence this process? These findings suggest that the answer is "not very much." This is doubly true when the interdisciplinary domain falls through the cracks between colleges and the local institute foci (e.g. crossing engineering/natural sciences and humanities/social sciences, as in the case of Team B). By way of epilogue, we note that Team B has undergone changes in membership and seen moderate success in research grants which would demonstrate the track record needed for a large center grant. The end of Team A's existing grant coincided with an ending to regular meetings. One member has moved into an administrative position within the institution, which we are optimistic will provide much-needed empathy to help ease tension between faculty and administrators.

While there is an unquestionable conflict between the disciplinary department structure of most universities and the interdisciplinary research they claim to promote, this hierarchical departmental structure will not disappear any time soon. The authors assume the number of research centers and institutes on U.S. university campuses will continue to grow. Thus it is imperative that we understand not only the potential benefits of such centers and institutes as means to knowledge production and scientific discovery (Bozeman & Boardman, 2003; Etzkowitz & Kemelgor, 1998) but also how they are developed and created. For many institutions, interim policies designed to mitigate the effects of the institutional barriers are a more viable option than more radical policies, such as removing academic departments altogether. It is our hope that

this analysis will help institutional and departmental administrators understand some of the current barriers to interdisciplinary research center establishment (real and perceived) that faculty members face, and in turn work toward removing them—a result we have observed in related work (Boden & Borrego, in press). Administrators must critically evaluate which disincentives and institutional barriers to interdisciplinary research exist within their respective institutions. As administrators acknowledge the need for department interdependence within the larger institution, loss of autonomy at the department level becomes a necessity (Seymour, 1995). Since interdisciplinary efforts require additional incubation time, a greater investment may be required. However, in the current budgetary climate this kind of investment is not likely to be made by departments themselves. Accordingly, clear and appropriate criteria for selecting and evaluating the most promising institution-level interdisciplinary investments should be identified, potentially through such mechanisms as formalized strategic planning.

Akin to a fundamentally different organizational structure, fundamentally different evaluation criteria are needed for interdisciplinary research. In theory, allocating percent effort among all co-investigators seems logical and fair, but in practice these contributions are valued as less than solitary efforts. When applied to co-teaching or coauthored publications (especially in some quantitative faculty evaluation “point” systems that treat these as fractional contributions), the devaluation is even worse. Interdisciplinary collaborators do not simply divide and conquer a project only to reassemble the completed parts seamlessly; tremendous additional effort is invested in integration across disciplinary perspectives and evaluation criteria. Synergistic contributions to the integration and production of knowledge across disciplines can be significant (Creamer, 2004) yet are completely ignored when interdisciplinary projects are treated only as the sum of constituent disciplinary parts. Though the effort totals one paper or grant, interdisciplinary collaboration is still viewed as a zero-sum game or compromise in which everyone loses (returned overhead) and no one wins.

Finally, once more appropriate policies and criteria are established, entrenched norms and perceptions will slow their full implementation and buy-in. While the departmental structure as a disincentive to interdisciplinary research is a seemingly intractable problem that will take both time and radical change to solve, attention to it is critical for the continued success of universities as leading producers of new knowledge. Future work should complement the limitations of this study by including the perspectives of administrators, funding agencies, and a broader sample of faculty members and institutions.

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Appendix

Figure 1
Interdisciplinary Collaborations and Organization Hierarchy

