A Good Place to Do Science: A Case Study of an Academic Science Department

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Executive Summary

Purpose
We studied an academic science work environment that has been conducive to the advancement of women faculty and students to identify elements that have facilitated high quality science and gender inclusion.

Methods
We conducted this study using several qualitative methods including document & archival research, direct observation, and 29 interviews of departmental members (faculty, staff, post-docs, and doctoral students).

Findings
Four types of constructive interactions support high quality science and inclusion. We list them here in increasing order of complexity, trust level required, and work impact:

- Collegial Interactions – basic respectful, civil and congenial interactions.
- Tacit Learning Interactions – interactions related to faculty obligations that provide opportunities for conveying and learning the work and norms of the environment.
- Relational Interactions – interactions through which close professional and or friendship relationships are formed and maintained.
- Generative, Resource-Building Interactions – interactions through which important resources are provided, received and or generated between individuals and for the group.

Five participative departmental activities, initiated or explicitly supported by the chair, facilitated constructive interactions:

- Team teaching with participation across faculty ranks.
- A variety of department social events, some of which occur after hours and others, which are family friendly.
- Participative faculty meetings in which information important to all faculty members is shared and the opportunity for decision-making input is provided.
- Participative faculty recruiting through which all faculty members have input into the selection of new faculty. Broad support for the new faculty member is established through this activity.
- Regular applicable research presentations and seminars that stimulate ideas and provide feedback and modeling of approaches to research and effective presentation of ideas.

Constructive interactions and participative departmental activities create and sustain a cooperative and productive workplace culture through the following five inclusive departmental processes:

- Valuing of high-quality, interactive science
- Transparent decision-making processes
- Engagement of faculty across ranks
• Professional respect, trust, and caring relationships
• Helping, cooperative behaviors

The following five *inclusive leadership practices* of the chairs facilitated the development of the department environment:
• Support of the advancement of good science, regardless of whose lab it emerged from
• Treating everyone fairly and equitability
• Seeking input from faculty in decision-making
• Promoting meaningful opportunities for interaction
• Taking a service approach to the role of chair

**Conclusions**
The study of this academic science department demonstrated the conditions under which high quality science is achieved in a cooperative and inclusive work environment. The core elements of academic science environments that are both relational and scientifically productive are constructive interactions, participative departmental activities, inclusive departmental processes, and inclusive leadership practices. Leadership plays a key role in the development and maintenance of this kind of departmental culture that not only benefits women and facilitates their advancement and productivity, but also benefits men.
PURPOSE OF THE STUDY

This case study of a science department at a Tier 1 research institution is a component of the NSF ADVANCE program with the objective of institutional transformation that will effect tangible change for women in science and engineering. The proposed case study description from the NSF ACES (Academic Careers in Engineering and Science) grant proposal document is as follows:

“[Conduct] a case study examination of the [Science Department] as an example of a department with a history of strong participation and advancement of women faculty. The goal will be to identify the departmental conditions that foster full participation of women at all academic ranks. The Science Department is nationally ranked in the 7th percentile. It has 19 faculty, 5 of whom are women, 2 at the full professor level. The female department chair was recently elected to the National Academy of Sciences. Although the department has no defined policies in this area, it provides an excellent case study site for examining the working environment conducive to the advancement of women faculty and students.”

Our research questions were:

• How does a work environment, conducive to the advancement of women at all levels, work?
• How do people interact with each other in such an environment?
• What is done to create inclusion, productivity, and high quality science?
• What cultural processes and practices operate in this academic science environment?

METHODS

We conducted this study using several qualitative methods after obtaining IRB approval.

Document & Archival Research
We collected basic information about the department such as the department structure, activities, and formal policies and processes from the university’s archive, the schools’ website and documents provided to me by department members. We also obtained published copies of faculty members’ bios and published department rank data.

Direct Observation
Observation allows the researcher to collect data on relevant behaviors or environmental conditions (Patton, 2002; Yin, 2003). We observed several department-wide presentations, two candidate job talks, and a student’s dissertation defense and post-defense celebration gathering.

1 We will refer to the department studied as the “Science Department” in this report.
We also observed a faculty meeting at which faculty members discussed a candidate for a tenured faculty position. We visited all the primary faculty labs at different times of the day and week in order to understand the work setting and routines. See direct observation guide in Appendix 1.

**Interviews**
We conducted semi-structured, one-on-one interviews (Knight, 2002), of about 1 hour in length, with all of the primary faculty and a willing sample of active secondary faculty, doctoral students, post-docs and staff. The focus of these interviews was participants’ personal experience within the work environment, their perceptions of the environment and the impact of this environment on their work and careers in science. See the sample interview guide in Appendix 2.

**Data Collection and Analysis**
Following Yin (2003), we bounded the sampling frame of this case by department membership or direct affiliation. We conducted interviews with all 16 primary faculty members, three of whom were women. Two women were at the full professor rank, including the chair. The third women had recently advanced from the junior to associate faculty level. We interviewed four secondary faculty members based on willing participants from among the seven who had an active role in the department. “Active” secondary faculty members were those faculty members who were training students from the department, were involved in teaching, supported recruiting and attended department presentations. However, secondary faculty members were not directly involved in department decision-making. The secondary faculty participants consisted of two women at the associate rank and two men, one at the associate rank and the other at assistant rank. We audio recorded and transcribed most of the interviews. Four participants preferred note taking of their interviews.

Of the administrative staff and laboratory staff within the department, we interviewed three staff members. They provided their observations about how the department operated and observations of faculty behavior and interactions. We also interviewed six students and post-docs following the protocol shown in Appendix 2.

**BACKGROUND – CASE STUDY SETTING**

The focus of this case study was a basic science research department at a Tier 1 research university in the United States. We will refer to the department, which was the focus of this study, as the Science Department. The Science Department was about 15 years old at the time of the study. It was formed in the late 1980’s during a time when an unprecedented number of women were entering the science programs and the science workforce. The women’s movement had made its mark on U.S. culture. Thus, for the first time in U.S. history, women were becoming visible in fields that had been dominated by men. Amid these societal changes, the Science Department was formed in response to the emergence of a fast growing area of scientific inquiry.
There have been two chairs of the Science Department over the course of its history, both female. The Science Department achieved top program and NIH funding rankings among departments in its field during the tenure of the first chair. It maintained its high rankings as it continued to grow in size under the second chair.

At the time of the study, the department consisted of 16 primary faculty members, three of whom are women (all tenured). The department is ranked above average in terms of number of women faculty and number of female students according to a science organization related to its field (ASDP, 2004). Two women faculty members were recruited to the department at tenure ranks. One woman has advanced from junior to associate rank. Of eight faculty members who joined the department as junior faculty, including one woman, only one male did not advance to tenure. Women comprise about 56% of the students in the graduate program, which awards masters or PhD degrees. The department attracts top students as indicated by higher than average student GRE scores for the field.

The department has a history of collaboration across disciplines and the secondary faculty members reflect a range of scientific disciplines, including psychiatry.

**FINDINGS**

In this section, we identify and discuss the four main constructs that emerged from our analysis of the data from various sources: constructive interactions, participative departmental activities, inclusive departmental processes, and inclusive leadership practices.

**Constructive Interactions**

How is the cooperative science environment of the Science Department produced and maintained? We found one answer in the quality of interactions that occur regularly within the department. Regardless of gender, tenure, rank or nationality, participants reported a variety of supportive, useful and/or instructional interactions with peers, post-docs and students. These interactions led to positive feelings about faculty peers and/or advanced people’s work in some way. We used the term “constructive interactions” to identify the interactions related to these positive experiences. Constructive interactions are interactions (both emotional and task related) that facilitate doing high quality science in a cooperative work environment.

It is through constructive interactions that departmental members contributed and received valued resources to and from colleagues in the work environment. For most faculty, giving, receiving and, for an active subgroup, generating these resources through interactions were viewed as essential to their work, their identity and their feelings of engagement in science.

Constructive interactions involve exchanges of resources starting with what Isabelle Bouty termed “common resources”. Common resources include information on published papers,
general scientific/technical information or “non committing services” such as the giving of names or addresses of other contacts. They require little effort to provide and are a very small part of what a person can offer another (Bouty, 2000). Exchange of common resources may mark the beginning of interactions leading to the exchange of “strategic resources”. Strategic resources consist of tools, techniques, samples, specimens or personal services that directly assist a scientist in advancing his or her work.

Both common and strategic resources are instrumental in nature. They facilitate or directly support work outcomes. However, other interactions in the department occurred around another key resource, emotional support. Emotional support consists of counseling, friendship, and role modeling, “that helps participants develop self-esteem and professional identity” (Thomas, 1993 p. 170). It thus, fosters feelings of energy, pleasure, satisfaction, and fit. “Fit” is the term that one male and one female participant in this study used to describe their feelings of congruence between their personal style and needs, and the work environment of the department.

Faculty members exchanged both instrumental and emotional resources, through constructive interactions. We found four types of constructive interactions, which we will describe briefly in the following sections.

**Collegial Interactions**

Collegial interactions are congenial, social civilities that occur between scientific peers in formal or informal settings. These interactions are not directly related to work outcomes. In the Science Department, collegial interactions included polite exchanges of greetings and courtesies, providing general information or “common resources” and or getting-to-know-you type conversations that could lead to instrumental and emotional exchanges. These interactions took place during day-to-day encounters in passing, and at social venues such as before academic presentations or faculty meetings. They also occurred at scheduled social events such as the department’s beer hour or the department picnic.

Generally, collegial interactions are introductory interactions that form the basis for more complex and productive interactions. They also maintain connections between departmental members, who may not otherwise have a need to interact. Both men and women in the department reported these social interactions. We also observed such interactions at department meetings and events. A female student observed:

“I kind of got the feeling that people here at least spoke to each other as opposed to being locked up in their labs all day and not getting along or having time to socialize.”

**Tacit Learning Interactions**

Tacit learning interactions occur around formal work roles and activities associated with faculty obligations. These reported interactions include formal mentoring of junior faculty to the extent that it occurs, serving on student committees, and activities that are a part of the graduate program such as teaching, advising, and weekly scientific presentations. Tacit learning
interactions provide important opportunities for faculty to observe and learn from each other. Faculty in the Science Department modeled and reinforced cooperative norms and behavior through these interactions. This was particularly important for junior faculty since there was little formal ongoing mentoring that occurs in the department. The participation of faculty in tacit learning interactions, regardless of rank, also distributes the department’s non-research workload, which is important to junior scientists trying to establish their labs.

Participants also reported that the way people went about these interactions made the required tasks more pleasant. One male professor noted that even as a small group of faculty wrestled with a difficult workload obligation, they maintained open and honest communication about the situation, concern about the welfare of all involved, and awareness of the potential impact on the department as a whole.

Relational Interactions
Relational interactions are interactions that help form, maintain or strengthen professional and or personal relationships. These interactions consist of taking interest in others, providing care and providing emotional support in the context of professional or personal friendship or colleagueship.

“He [A male full professor] genuinely sounded interested in his research, which is usually the case, but he was also interested in what I had to say. And, he asked me how I felt about the idea of coming to work in the lab. I thought he seemed very interested in me and how I was, not just telling me what the lab is about, and finding out about my resume. He was just very upbeat, and overall just gave me the sense that it was a happy lab. You can tell, if you're paying attention, if somebody's really got a happy lab going on.” (female staff researcher)

“But this environment is so much more like family than it is like work-mates who you don’t talk to or care about or see much outside of the work space.” (female post-doc)

There are several faculty members, both male and female, who came into the Science Department with prior knowledge of or established relationships with faculty in the department. However, other faculty members, for whom relational interactions began in the department, initiated relational interactions around shared, similar, or related research interests. Such relational interactions appeared to be an outgrowth of collegial and tacit learning interactions.

Some relational interactions were apparently facilitated by the fact that several of the faculty live near each other in a small suburb near the university. Two faculty members retold the “ladder story” that exemplified the nature of the relationship between some of the faculty and the kind of department they valued:

“So when I came here, when I interviewed here - the professor that used to be in the office next to me - He had told a story of the department having this ladder. It turns out, that three or four of the faculty got together and bought an extension ladder for cleaning
their gutters. And every fall they’d drive it around to their different homes and help each other do their gutters.” (male associate professor)

The message that he took away from this story was that we have our separate labs, but in this department, we support the success of everyone’s lab. He reported this was a very different orientation to department life than he had experienced in graduate school.

We noted two relational events around emotional support. One we observed at a meeting as faculty members offered condolences to a colleague about a research setback. The other was a story around support as a group of faculty grappled with a difficult administrative situation.

“It’s been interesting to me that many of the faculty have come up to me and said, “I’m really sorry this is a situation and if we can help, let us know”. That’s community.” (male full professor)

Several faculty members perceived that, as a whole, people were interested in each other’s success in doing good science. Several faculty provided examples of celebrations that highlighted the separate accomplishments of a male and a female peer. Interest in each other’s success could be an important condition for positive interactions in general within the department.

Men reported personal informal relational interactions that occurred after hours over beer. These informal personal talks are reportedly open to all faculty members. However, only men reported attending these gatherings. Women did not report awareness of these meetings or a feeling of exclusion from these relational interactions. In other research studies, women have reported feeling excluded from informal relational interactions. They perceive that men share important information and make important decisions during such interactions. Thus, women’s influence in decision-making and access to information is diminished. In the Science Department, there are open channels of communication through other types of interactions. Also, it appeared to us that there is broad support of transparent decision-making processes with the department. We will discuss these processes later in this report. Suffice it to say at this point that access to transparent, alternative information and decision-making processes may explain why women in the Science Department did not indicate feelings of exclusion or lack of influence due to gender.

The majority of reported relational interactions, for both men and women, consisted of informal, sometimes lengthy conversations about science. Most female faculty and two male faculty members reported relational interactions, involving discussions of work-life balance, with students and or post-docs, in the context of mentoring relationships.

Social, role, and relational interactions support more complex, riskier and high yielding interactions that we will discuss in the next section.
Generative Interactions

Generative interactions are the most overtly interdependent and complex of all interactions, and reflect the building of resources within the group. Generative interactions may start with a one-way provision of resources in response to a request from a peer. However, as people respond to receiving a resource by providing a different resource to the giver or responding generously to others, more resources are made available to the group, thus the term generative.

Generative interactions appeared to occur in the Science Department as part of ongoing relationships within groups. They require trust that a peer will not use these resources to directly compete with or “scoop” each other. A male associate professor reported that this kind of competition was “not a factor” within the Science Department.

Faculty members provided many examples of generative interactions. One example was reported between a female faculty member, who was an assistant professor at the time, and a senior male faculty member. Mutual interest in a particular organism led to an answer, which supported the male professor’s research and lead to a funded stream of research for the female professor. In another example, a female full professor received technical and material assistance from a male associate professor. She then provided him with useful data from her use of the resources he provided her. In a third example, three junior faculty members cooperatively secured a shared equipment grant necessary to replace a vital but outdated piece of equipment.

Faculty members talked about how important this access to resources was to their scientific work, as exemplified by this statement:

“Here in the Department, everybody is working on completely different projects and topics. I think where we try to help each other is with the techniques. So if I see somebody is doing, let’s say [name of a technique] and I can’t do this. I go to him, and I try to learn it there. There are a lot of techniques in the Department, which are available, (and) that you could use and gather. That’s what a Department is for.” (male assistant professor)

Other types of generative interactions involved steering funding opportunities to other labs, and helping peers, even those in other departments, to obtain funding. One female professor referred to these activities as “looking out for each other”. Being “looked out for” appears to promote a kind of reciprocity in the receiver that encourages her or him to pass along resources to others who are seen as part of the Science Department community.

Generative interactions provide resources that directly support the research of scientists in the Science Department. Thus, they have implications for the ability of scientists to pursue their work and advance in their careers. Etzkowitz, Kemelgor and Uzzi (2000) describe these interactions and the resources they refer to as “social capital” work:

“Typically, men form close social ties with other male colleagues within and beyond the department that facilitate access to collegial resources and information, which in turn
help them to identify promising studies, manage jobs, or learn the politics of tenure and publishing” (Etzkowitz, Kemelgor, & Uzzi, 2000, p. 159).

They go on to report that this sort of social capital is typically unavailable to women scientists, who tend not be a part of those social networks. In contrast, in the Science Department, both women and men reported participation in generative interactions that advanced their research.

Some scientists had also come to believe that going it alone was a bad idea competitively. They actively supported interactions that maintained the autonomy of labs while leveraging different resources available across labs to create new resources. Some faculty members viewed these interdependent interactions as central to survival and success in the increasingly competitive environment of science.

“The thing that makes the department different from being 16 independent entities is that there’s interaction and there can be guidance. There can be support between these self-contained laboratories. To some degree, that’s forced by the system, because you have to have other faculty involved with training your students. Usually you have other faculty involved in teaching courses... and there are more and more cases. I think the better the department is, the more cases there are of faculty working together on things that benefit the department but not necessarily an individual faculty member exclusively.” (male associate professor)

“Also, right now, I think the way the NIH is funding things, I think it becomes more important to have these-- And they’re really pushing these cross interactions. It’s going to be hard for any lab to survive for a long period of time all by itself, without interacting with anybody because no lab can do every technique. It just doesn’t work anymore.... They’re going to have to find their interactions among their colleagues. (female full professor)

Many faculty members recognize that these generative interactions are important to providing the knowledge and resources needed to compete with larger labs, while still maintaining their own laboratories and pursuing their unique ideas.

The congenial environment of this department depends on the first three types of interactions we have presented here. However, generative interactions specifically help advance a scientist’s work and career. These generative interactions increase the knowledge, resources and capabilities of scientists across labs, and even across departments. While it is possible to develop these interactions outside of the university, like many scientists do, when they occur in a department or within an institution, the efficiency of interactions is improved (walking down the hall vs. phone calls, emails and papers sent across country) and the capabilities of that department are improved as a whole. Those whole system capabilities can still be shared in the larger field between institutions.
Over the years, both chairs of the Science Department, with the support of faculty, introduced several department level activities that appear to promote high quality interactive science. We will discuss these activities in the following section.

**Participative Departmental Activities**

A combination of five different types of participative departmental activities, initiated or explicitly supported by the chair, were instrumental in advancing constructive interactions.

**Team Teaching Across Faculty Ranks**

Team teaching of courses within the graduate program had been practiced since the days of the first chair. Various faculty members, across ranks, participated in teaching parts of the graduate program. Advantages of this approach mentioned by faculty included:

- A manageable teaching load for all faculty
- A lower load for junior faculty, thus giving them time to devote to lab start up
- Opportunities for junior faculty to learn from more senior faculty
- Opportunities to interact with faculty that one might not normally interact with

A junior faculty member viewed the advantages of team teaching as follows:

"Doing the teaching, I found to be quite a lot of fun, because it was a team-taught course. So I actually interacted with people that I wouldn’t normally have interacted with. Getting an insight into what they do every day was interesting. I hadn’t had that perspective before…It was just good to actually talk to them in a setting that was more of a work environment, rather than necessarily say a social environment because sometimes you discuss things that are more work related if it’s a teaching environment. Where if it tends to be a social environment, then you don’t always find out as much about the work they’re doing at that time.”  (male assistant professor)

Since the department does not provide ongoing formal mentoring of junior faculty, these built-in interactions like team-teaching provide an important means of informal socialization and development of junior faculty.

**A Variety of Contexts for Collegial Social Interactions**

As the department has grown, the opportunities for spontaneous, informal social exchanges have diminished. Under the leadership of the current chair, the faculty agreed to various department-level social oriented activities to afford faculty, students and post-docs opportunities to interact outside of their labs. These activities include a weekly beer hour, which is sort of a “science happy hour”. Beer hour rotates between labs, the faculty and students. Rotating beer hour between laboratories gives each lab visibility and enables different labs to put their own twist on the event. For example, one laboratory used a chili theme thus focusing the event more on tasty food. Thus, all of the laboratories are involved. The chair also introduced a department picnic.
and retreat. The picnic in particular provides a more family friendly context for interactions. These events provide opportunities for collegial interactions between faculty members.

Participative Faculty Meetings
The chair used faculty meetings to keep faculty informed and engaged in decisions that could affect their work. The participative style of the chair, the interpersonal skills of the faculty, and mutual respect demonstrated by all participants kept these meetings constructive and on task. We noted that participants took the time to elicit and consider multiple views and information in decision-making. A faculty member later commented on a meeting we observed as follows:

“But you have to have the respect for each other. When you get that, then you listen to what other people say in the meeting...You may not agree with them because you realize they come from a more-- they’re looking at something in a more lenient way then you would look at it, but you can’t sort of just say, “Well, that doesn’t count.” Or “That’s not important.” (female full professor)

Constructive faculty meetings appeared to be an important means of promoting workplace inclusion around decision-making and information dissemination.

Participative Faculty Recruiting
People in the department and newcomers have to be mutually drawn to interact professionally, and engage in “strategic resource” and emotional exchanges that build professional and in some cases personal relationships. A process that facilitated this in the Science Department was the group recruiting of faculty candidates. All faculty members participated in this process as interviewers, hosts, evaluators of presentations, and decision makers (or advisors if they were secondary faculty or had had minimal contact with the candidate due to schedule conflicts). This process not only gave faculty the opportunity to provide feedback on the candidate, but also encouraged faculty to think as a group about how this person fit into the department, what the candidate could contribute, what the candidate’s developmental needs were, and whether department members were able and willing to help that person develop as a scientist.

We observed a seminar, “chalk talk” and faculty meeting surrounding one candidate for a junior faculty position in the department. We noted that a significant amount of the discussion about a candidate was about both fit with the department, in terms of the person’s research direction and his or her ability to interact with others. Faculty looked at the strengths and weakness of the candidate’s science. Strengths were areas that the candidate could leverage into funded research and capabilities the candidate could provide to departmental peers. Faculty assessed weakness in terms of likelihood that people in the department were willing and able to help the candidate develop as a faculty member and if the candidate might be receptive to that help. A faculty member referred to the same meeting as follows:

“And I think that everybody sitting in there...you could listen to the conversation and you could see people were thinking about how this person would contribute, particularly in the meeting that you were sitting in on. So how could this person contribute to the
department? But also, “We have to mentor them”. So, are they [the candidate] in a position where they can be well mentored? Or are they so far back that people will be spending a lot of time, too much time, doing the mentoring? You want somebody where you see that, if you put in the mentoring, it’s really going to pay off. You want to know that. So I think everybody sees how the whole thing affects him or her.” (female full professor)

The result of this process was a candidate people felt good about, which provides the new person with a cache of social credit needed to weather any initial setbacks that may be part of the new faculty experience.

“And that’s why I think the recruiting as a group is important because you want to bring in people that everybody feels good about.” (female full professor)

Feeling good about a person promoted interest in that person’s success and encouraged acts of inclusion.

“But I think the strength of the department is that it’s got a large group of faculty that has been involved in hiring the people. [These faculty] are now invested in many people in the department because they played key roles in their recruitment. And so we’re trying to work on ways, through the infrastructure of the department, to expand the circle. To have people more interconnected with other labs, so we’re trying to find ways to have the labs that aren’t involved in this central cluster of faculty be more involved in having them on students committees, having them on exams. Try and reduce the ability of people to be really isolated.” (male associate professor)

**Regular Meaningful Seminars and Presentations**

Many faculty members mentioned the importance of department seminars and presentations in stimulating ideas, helping them to fashion their own projects and making contact with peers with mutual interests. Two students also indicated that the interactive, interesting, and well-attended research seminars attracted them to the department. The faculty emphasized the importance of these seminars for the development of young scientists by making the sessions mandatory for graduate students. Faculty, both primary and secondary, attended the sessions we observed. The room was abuzz with conversation among faculty before the presentation. Faculty members were responsive to the presenters. Some faculty nodded their heads in either agreement or encouragement. Others asked questions that helped the presenter clarify points or consider new angles. Afterward, some faculty lingered, talking with peers and students. Thus, seminars and presentations were an important means for constructive interactions.

**Inclusive Departmental Processes**

Constructive interaction and participative departmental activities created and sustained a productive and cooperative departmental culture through the following inclusive processes.
Valuing of High Quality, Interactive Science

The value of high quality, interactive science was a driving force underlying all departmental interactions and activities. Department members often stated the goal of doing “good science”. People saw science as a lifetime pursuit, requiring dedication, cooperation, and interaction. Departmental members noted that the creation of a culture of good science required working with more junior members of the department to develop their scientific skills, as well as to contributing equitably to non-research departmental responsibilities such as service assignments and teaching. They perceived the advantages of a resource rich environment in order to pursue good science.

A broad definition or image of “doing science” was established early in the life of the Science Department. A scientist is not a “lone wolf”, as one faculty member termed it, “in his or her own world competing with the outside world to get a paper published or get more money” (female associate professor). A scientist is autonomous in terms of the management and direction of his or her own lab but interdependent in terms of resources to do the work and impact of the outcomes of her or his work.

Etzkowitz, Kemelgor and Uzzi (2000) explain:

“...their [women’s] relationships with male colleagues tend to lack the close personal relationships and high levels of reciprocity they observe in male-to-male relationships within their departments. …Whereas male faculty work in closely knit social networks of exchange – in ‘Kula rings’ – that belie the conception of the lone scientist finding truth in isolation form outside influences, this lone scientist conception is imposed on women, undermining rather than enhancing their ability to succeed.” (Etzkowitz et al., 2000)

In the Science Department, women are included in the “Kula rings” of exchange, which begs the question: What has facilitated the inclusion of women in this department? Part of the answer lines in the backgrounds of many of the department members. Some came from cooperative environments. Others were dissatisfied with the competitive or isolating environments they had encountered before joining the department. The founding members of the department valued cooperation, collaboration and high quality science. The first chair actively recruited good scientists who wanted to work cooperatively. She, with the support of early faculty members, advocated creation of a “strong department” (male full professor), as opposed to competing laboratories. This meant that all laboratories needed to succeed, regardless of the gender, age, nationality etc of the managing professor. Today good science is still a key criterion for faculty membership. Being able to get along with peers is still important. However, several associate level faculty members articulated a more elaborated view of good science as “interactive”.

"I think they have to be an interactive person to make the group better. You know they can't just sit in their lab and be a great scientist and never talk to other people. It is good scientists that participate in group activities that have a broader impact on the department and university, because they transmit their
ideas to students, post-docs, and other faculty members in the department.”
(female associate professor)

Thus, members of the Science Department held two beliefs that were the foundation for the department’s cultural environment. These shared beliefs about science appear to provide the basis for inclusion in the Science Department.
1. Good science is the pursuit of meaningful, significant advancements of knowledge.
2. Good science is achieved through interactions between scientists that provide and generate resources.

This dual value base has produced a department that is ranked 15th in the world. The department is consistently in the top 10 in NIH funding (Department, 2000; Gourman, 1996). Several faculty members have international reputations as experts in their area of research including one member of the prestigious Academy of Science.

Transparent Decision Making Processes
All faculty members had the opportunity to be a part of important decision-making processes. Department members felt informed about matters that affected them and their work. They felt that they could influence the decisions that affect their immediate workplace. The faculty meetings and, in particular, participation of the entire faculty in recruiting, were the means to transparency. These activities removed the mystery around important questions, such as who was involved in the selection of a new faculty member or how the hiring decision was made. Also important was that decision-making power did not appear to be held by any single individual or sub-group (e.g., senior professors, professors of certain status or standing in the field, or by age or gender sub-group). Thus, transparency was an important tool for creating inclusion.

“So in general, for the recruiting, I think that everybody knew their input counted. In the end, we did go the way that the group decided for all the positions.” (female full professor)

“So there aren’t any politics, and nobody’s being forced to do things. People are genuinely interested in teaching or are certainly interested in the job search. And so it’s sort of a team effort, which makes it rewarding. I think that there is not very much of a hierarchy in the Department, between the junior faculty and the senior faculty. And, to some extent, the students feel like they’re part of the process. So people feel empowered. People’s opinions are asked and they receive feedback.” (male full professor)

The transparency of decision-making processes, and faculty’s stake in the success of others, helps to maintain trust and supports cooperative science within the department.
Engagement of Faculty Across Ranks

Faculty engagement in a variety of activities from team-teaching to the department picnic demonstrated their desire and ability to interact. This reduced the chances for isolation, and increased the chances of finding opportunities to generate and share new resources. Furthermore, by cross-rank sharing in the activities of recruiting and teaching, the academic workload of the department was more evenly distributed. This non-hierarchical distribution of the service and teaching responsibilities appeared to have a status-leveling effect within the department. Joint recruiting distributed decision-making power and responsibility throughout the department. Through joint teaching, junior and new faculty members were not individually burdened with large teaching responsibilities just as they were trying to get their labs off the ground. Junior faculty also gained access to more experienced and higher-ranked faculty than they might normally interact with.

“So I give some of the lectures in the course [graduate level science course], but I also organize everything like the exams and the handouts and grading, etc. Quite a few people in the Department cooperate. About six different people give lectures that have to be coordinated. It’s a very positive experience. People are very willing to do it and they meet deadlines that I set for them and do their best. And the students seem to like the course.” (male full professor)

Professional Respect, Trust, and Caring Relationships

Faculty members noted that relationships with others were important to their work. Many faculty members expressed respect for their peers’ work. As a whole, faculty members were confident in their work as scientists and were willing to do the work to produce quality science. Some expressed pride in the department as a whole. The absence of direct competition made it safer to trust each other and to take interest in others’ work and development. These respectful, caring, and trust-based emotional conditions allowed department members to be committed to each other’s work and success.

Participants readily talked about their perceptions of the nature of their work environment in general and how the department’s environment had facilitated their work and careers as scientists. Many were attracted to the department because they perceived it to be an environment where people interacted in positive ways that fit with their own approach to science.

“I was going to someplace with nice people, who treat each other with respect; and with a scientifically vital environment, where I myself know I could thrive and this is it. It doesn’t get any better than this. This is one of the best places to do this stuff on the planet. I feel honored to be here. And my colleagues, I mean, may not be this enthusiastic about it, but most of them feel the same way, I think.” (male full professor)

Helping and Cooperative Behaviors

The department’s culture was characterized by helping and cooperative behaviors that assisted department members in doing their work. Peers were willing to share access to scarce academic and network resources. This willingness to share also made identification and acquisition of new
resources possible. Age, tenure and gender inclusion was evidenced by the broad participation of faculty in helping-related behaviors.

In the Science Department, people reported access to role models for approaches to the work, peers they could generate ideas with, and access to important new techniques and methods being available for the asking. Faculty described their peers as “friendly”, non-competitive and the department as having “no slackers”.

“There was no one that had some sort of negative agenda going on, and people were friendly. People were collegial. If you had questions, you could go talk to one another very freely. You could ask people for advice, people that were more senior to me. I found it be very harmonious and productive in a cooperative environment.” (male associate professor)

The cooperative environment of this department was not a gender-specific goal. Most faculty members regarded a cooperative environment as a valuable and highly effective way of doing science.

“You know, I think the environment is really important throughout one’s entire career, especially these days where it takes different expertise, methodologies to complete a research project. For example, there are certain methodologies that I don’t know how to do, but my research would benefit from it. If I’m in an environment where that methodology is not available, I’m out of luck. But if I have a strong environment that’s relevant to my research, I may be able to go to go down the hall and ask someone to help me interpret data or help me to use a method that I don’t know how to use, to help advance my research.” (male associate professor)

Overall, participant’s characterized relations in the department as “cooperative”, “supportive” and “smooth”.

“So I would say the one thing that’s very clear in this Department, as opposed to some places where I’ve been, is that people get along with each other and that makes everything a lot easier.” (male full professor)

**Inclusive Leadership**

Leadership also played a key role in the development and maintenance of the department’s culture. The current and past chairs employed very different leadership styles, but shared similar orientations, to the goal of high quality science. First, both chairs supported a workplace environment in which people were energized by the value of the work itself – the advancement of science. Faculty perceived both chairs to be fair and equitable in their dealings with departmental members, supporting the advancement of science regardless of whose lab it emerged from. Several faculty members, both male and female, noted the fairness and
forthrightness of the current chair. No one reported either chair as having favorites or supporting cliques. Second, both chairs sought the thoughts and opinions of the faculty before making decisions. When the department was small, the first chair did so by talking to faculty one-on-one. The second chair employed more group-level activities. Both provided the faculty with a sense that a wide range of opinions mattered, not just the desires of the chair or a privileged subgroup. Both chairs created opportunities for faculty members to engage meaningfully across ranks, through the various activities that we have described in this report. Third, neither chair treated the department as an extension of her self or her own work by monopolizing resources and recognition for their own ends. They did not use their status to demand unwarranted resources, authorship or access. Instead, they created and shared resources to support others’ labs, particularly those of junior faculty. Participants cited many instances of the chairs securing funding for new faculty, including one story of the current chair allowing a junior faculty member primary authorship of work that the chair’s lab had supported. Thus, both chairs viewed their role in terms of doing a service to the department, not as a reward to be leveraged.

The specific inclusive leadership practices of the chairs that facilitated the development of the department environment were:

- Support of the advancement of good science, regardless of whose lab it emerged from
- Treating everyone fairly and equitability
- Seeking input from faculty in decision-making
- Promoting meaningful opportunities for interaction
- Taking a service approach to the role of chair

**CONCLUSIONS**

Etzkowitz et al., (2000) conducted a study to determine the characteristics of graduate departments that showed the most and least improvement in recruitment and retention of women and conferring of the Ph.D. degree. This study was based on 1974-1990 statistical data from the National Research Council. They found that the vast majority of science and engineering departments reflected “negative attitudes towards women in science”. These departments they termed: “instrumental”. They also found a few departments with a: “collegial and cooperative atmosphere that provides the safety to take the risks necessary for innovative work and the collaborations necessary for networking” (Etzkowitz et al., 2000, p. 181). They termed these departments “relational”. A characteristic of relational departments was their attractiveness to “a number of tenured women faculty who had struggled for recognition and status in prestigious graduate schools and post doctoral programs that were highly competitive and hierarchal” (Etzkowitz et al., 2000). Other researchers have also suggested that cooperative or relational departments are better environments for the development and advancement of women scientists (Rosser, 1999; Sonnert & Holton, 1995). The findings of the present study support their collective conclusions, and highlight that such environments are supportive and desirable to men as well.
At the core of a departmental environment that is both relational and scientifically productive are departmental processes such as conducting high quality science, transparent decision-making, inclusion of faculty at all ranks, development of caring and trust-based relationships, and cooperative, helping behaviors among colleagues. In such an academic work environment, faculty members see science as a lifetime, interactive pursuit – they choose not to rest on their laurels or take advantage of the system by leaving the heavy lifting of departmental responsibilities to junior faculty, whether male or female. Also, these people understand the advantages of a resource-rich environment in order to pursue good science, and creatively self-organize to gain access to scarce academic and network resources.

The Figure below represents our conceptual modeling of the relationship between the major constructs that emerged from the data.

To have access to and maintain this kind of environment requires constructive interactions between department members. Constructive interactions range from collegial departmental interactions to relationship building to generative interactions that give rise to synergistic connections. We found evidence of constructive interactions across dimensions of diversity like academic rank, sex, age, and nationality. The range, frequency and scope of people involved in constructive interactions may provide an indication of the level of gender and other forms of integrative inclusion within a department.
To move from one or two cooperative and collegial laboratories within a department to department-level cooperation also appears to require specific kinds of leadership support. The first chair promoted the idea of a “strong department” by recruiting scientists interested in working in a cooperative, collegial environment. The second chair added activities like faculty meetings and wider scale social gatherings that enhanced workplace inclusion in a growing department. With a core of scientists in place who valued the kind of work environment that was created, the recruiting process became essential to continue to bring in scientists with similar values who were willing to contribute to the resources of the work environment. The department chair’s role in facilitating participative recruiting practices among the faculty strengthened the department’s culture in this regard.

Academic departments often produce high quality science in competitive, isolating, and male-dominated work environments. However, the academic science department studied for this report demonstrated that high quality science could also be achieved in a cooperative, inclusive, and interactive environment, facilitative of the advancement of women scientists. In the words of a male associate professor, all these factors made the Science Department “a good place to do science”.

References

ASDP. 2004. Annual survey: Association of Science Departments and Programs.


Appendix 1
Observation Guide

Questions to guide observations of researcher during direct observation activities

Physical Space & Equipment

- What is the overall physical space of the department like and where are its members located?
- What are the workspaces like (Labs, offices, meeting areas?)
- What are the differences and similarities in workspaces? (Labs and offices)

The Work in the Department

- What is the work of this department and its members?
- Where do people typically spend their day?
- What kinds of work and ways of working appear to be rewarded or acknowledged in the department?
- What is the purpose of this department? What seems to be important based on what people send their time doing?

Work Norms

- When do people work?
- What are norms about group and one on one time?
- What dynamics occur around equipment? (Access, how much to use it, who uses it?)

Interpersonal Interactions

- Are people working with each other or individually?
- What kind of work requires interaction?
- What interactions are occurring here? (tasks, relational, informational)
- How and when do people interact with and or respond to each other? Who participates? Who doesn’t? How do people respond to non-participants?
- What are the styles of interaction?
- What kind of access to faculty do students and post-docs appear to have?

Groups

- What kinds of group meetings take place?
- Where do they take place?
- What are these meetings like?
- What is the purpose (information, idea generation, decision making)
• What kind of decisions made, and information conveyed.
• What is the structure (formal or informal agenda) and process (how is the meeting conducted)?
• How are agreements reached or disagreements handled?
• What are the interactions in such meetings (norms about speaking, order of speaking, who speaks and who does not)?

Leadership

• How do people display and respond to leadership? (Chair, program heads, committee heads, student leaders (if any))
• Are women “followers” or “leaders” in this environment?

Climate

• What do classes, research presentations and other broader group gatherings feel like?
• What is the overall tone or emotional feel of the department under various circumstances?
• Do people look comfortable?
• Are there indications that people support each other?
• Does the environment feel non-threatening?
• What do you observe about competitiveness in this environment?
• What do you observe about hierarchy?

Integration and Socialization

• How are new members brought into the department? What are the criteria? How are they selected? How are they introduced and socialized?
• What is expected of a scientist in this department? What do people appear to expect of each other?
• What are the observable rituals or some habitual behaviors in this department?
Appendix 2
Sample Interview Guide

(Review Informed Consent, answer any remaining questions, sign forms to formalize agreement to participate)

This interview consists of three questions about your experiences in the department and three open-ended questions about work-life and science. I will ask questions for clarification and detail and I will monitor the time. So here is the first question.

(1) What brought you to this department? (Secondary faculty: How did you become affiliated with this department?)

Prompts:
What appealed to you about this department before you joined?
How has your actual experience matched those observations or impressions?
For faculty here since department founding: How is the department the same now as it was when you joined? How is it different?

(2) Thinking back over the last 6 months to a year you have been in this department (or working with the department), can you tell me about a time that you felt positively engaged, happy or perhaps pleased with an activity that is part of your work.

Prompt:
This can be in research, teaching, service or department related administration.
Use adjective “satisfied” if participant does not relate to engaged, excited or interested

(3) Please tell me about a time that members of this department helped you develop as a scientist.

Probe:
What role did the chair play?

Clarification questions for questions 1-3 are:
What were the circumstances?
What was your role?
Who was involved? Not asking for names, just roles
What happened?
What was the outcome?
Aftermath, if any?

Closing probes:
In what ways do you feel you are valued or recognized?
For your work in this department?
As a person in this department?

(4) When have you had to make the choice between your career and other personal demands or important aspects of your life?
Prompts:
What can you tell me about the situation?
How was it resolved? (// phrasing: What was the outcome?)
What did you learn about your priorities through this experience?
What did you learn about the department through this experience?

Probes:
What kind or forms of support are readily available?
What kind or form of support were you offered from department members?
What kind or form of support did you request?

Note: An added question follows:

(5) What has been different about having women, married students or students of color in the department/lab vs. your experience in other departments/ labs (as a student or post-doc)?

Follow-up question:
Do you have a sense of how differences like gender, cultural or social background, or age have contributed to either the Science Department or the Institution?
   Probe if needed:
   What about gender or cultural background?

(6) To sum up: What is a “good scientist”?
Prompts:
Who is this person? (What characteristics?)
What are concrete things this person does to be good? Successful?
What kinds of skills and abilities does this person have?
What kinds of contributions does this person make?
What kinds of resources or support does this person need?
What is it like for you and others to be around (work with) this person?

   Probe for detail on factors related to personal characteristics, lab management, mentoring, funding, and or training.