

Report on the Research Facilities
Program Review Committee of the Graduate Council
May, 2009

Part 1 Executive Summary Report

1. Overview of the Review Process:

The Program Review Committee of the Graduate Council for 2008-2009 consisted of Nancy Mundschenk, Committee Chair, (Educational Psychology & Special Education) Leslie Lloyd (School of Allied Health), Eileen Meehan (Department of Radio-Television), Elyse Pineau (Speech Communications), Donna Post (Curriculum & Instruction), Michael Young (Department of Psychology), and Tomasz Wiltowski (Department of Mechanical Engineering & Energy Processes). The Committee was charged with the task of reviewing five research facilities at SIUC, under the direction of the Vice Chancellor for Research and Graduate Education. Subsequent to this charge, the Committee was asked by the Dean of the College of Agricultural Sciences to include the DNA Sequencing Facility in our review.

The committee has completed a review of the following facilities:

- Central Research Shop
- Integrated Microscopy and Graphics Expertise (IMAGE)
- Laboratory Animal Program
- Mass Spectrometry Facility
- Nuclear Magnetic Resonance Facility (NMR)
- DNA Sequencing and Allele Facility

The information used in this review came from the following sources: recent self-assessments or self studies completed by the facilities; accreditation reports and inspections; e-mail surveys of facility users (both faculty and students); personal interviews with the facility Directors (and staff if present); a tour of the facility; and the description of the facility from the university website. After summaries were drafted of each facility, the Directors were sent copies of their facility report to check for accuracy and completeness prior to finalizing the review for each individual facility, and writing this final executive summary.

The Program Review Committee would like to thank the facility Directors who were all very gracious and generous with their time, and seemed to genuinely welcome this review process.

The Committee has identified several recommendations to advance the work of these facilities in order to strengthen the University's standing as an intensive research institution whose world-class faculty provides students with an excellent education.

2. Role of the Facilities and Their Effectiveness:

These research Facilities play key roles in the University's achievement of its research and teaching missions as well as in attracting and retaining outstanding researchers and students. Overall, the Committee was strongly and favorably impressed by the six Directors' commitment to supporting research, providing learning experiences, and assisting University efforts in recruiting and retaining faculty, post-doctorate researchers, and outstanding students. We were similarly impressed by the Directors' success in these endeavors.

Research Mission: SIUC has to maintain its standing as a research intensive university and to achieve the goals set forth in Southern at 150. The Central Research Shop (directed by Mr. Gregory Moroz), Mass Spectrometry Facility (Dr. Mary Kinsel), Nuclear Magnetic Resonance Facility (Dr. William S. Stevens), DNA Sequencing and Allele Analysis facility (Dr. David Lightfoot), Laboratory Animal Facility (Dr. Scimeca) and IMAGE Center (Dr. John Bozzola) play key roles. The Directors and these facilities have played crucial roles in the conception and design of experiments, in conducting tests and analyzing data, in pursuing long-term research projects, writing and securing grants, training to use and supervising access to complex instruments, creating materials necessary to communicate research findings at national and international conferences, etc. For each facility and Director, the Committee has received user comments indicating the significance of the facility's services and the Director's expertise. While Directors are rarely recognized in journal articles, conference presentations, or University events publicizing projects on which Directors worked, the Directors and their facilities provide crucial infrastructure for research. Without that infrastructure, the University's ability to fulfill its research mission would be dangerously impaired. Such impairment would have ripple effects, damaging the University's ability to fulfill its teaching mission, making SIUC less attractive to applicants for faculty positions and to potential students, and signaling to current faculty and potential students that SIUC was stepping back from the commitments articulated in Southern at 150.

Recommendations:

Both staff and Directors deserve recognition for their invaluable contributions to the University's research and teaching missions. Such recognition in published articles, presentations, and University events would be helpful. Monetary recognition in terms of merit pay is always appropriate.

Teaching Mission: All of the facility Directors contribute to the University's teaching mission. Indeed, the Directors provide more teaching services than a casual observer might expect. Directors mentor individual students in formal and informal ways, train individuals on the use of instruments, give tours, conduct workshops in the facilities, consult with researchers, lecture

each semester in classes, design computer programs used in instruction, and, in Dr. Kinsel's case, teach two classes a year. Demand for teaching services will increase as SIUC hires faculty whose research programs and teaching assignments depend on the instrumentation available in the facilities. Demand may also increase as current faculty expand their research to include new instrumentation, and need to arrange lectures, workshops, training, etc.

Recommendations:

We have two recommendations regarding Directors' research and teaching functions. First, Directors' appointments should not be divided among multiple units but centered in the facility that they direct. Second, the University should recognize the Directors' support for the University's teaching mission in an appropriate manner, which may well include granting faculty status to Directors with the appropriate credentials.

Recruitment and Retention: The facilities play a significant role in attracting and retaining exceptional faculty, post-doctorate fellows, and both graduate and undergraduate students. Individuals who have just earned their doctorates or who seek a post-doctorate position will not be attracted to an institution that cannot support their research. Applicants for graduate studies will prefer an institution that has the instrumentation necessitated by modern research areas over an institution that has no such instrumentation. High school graduates who have won accolades for their academic work will seek – and be sought by – institutions that have the necessary facilities. Similar dynamics undergird the process of retention: individuals with active research programs who aspire to high achievement need to be supported. From user comments, we know these facilities have played a role in recruitment and retention, and that with some enhancements they can continue to do so.

As a result of our review, we have identified four areas of concern that are shared across the facilities, (salaries, staffing, equipment, and physical plant) and present recommendations relevant to the facilities' roles in fulfilling the research and teaching missions of the University, and in recruiting and retaining faculty and students. These recommendations are contained within the subheadings below.

3. Administrative Support:

The conduct of research, scholarship, and creative activities is at the core of the Southern Illinois University missions of education and research. Many of the SIUC research shops have received excellent reviews from their users, both external and internal. This clearly indicates that their existence is complimentary to the University as a whole and their performance is outstanding.

A major concern is the fact that there appears to be no plan for consistent and adequate allocation of funds to the research facilities. All the research shops we have reviewed operate as an independent unit and report to ORDA. In general, the research shops produce over 50% of their costs from revenues.

Recommendations:

If the University administration takes seriously its “Southern at 150” aspirations and plans to keep its Carnegie II status, it must develop a long-term strategic plan for securing the funds for maintenance and replacement of outdated equipment. Additionally, the matching funds should be organized by ORDA in order to increase the support of the research shops. One approach of doing this is the proper allocation of a portion of the “Facilities and Administrative Costs” coming from the externally funded research grants.

Salaries for the Directors need to be set at a level commensurate with their experience and must be competitive nationally. Second, the Directors’ salaries should be guaranteed in the sense that a percentage of the Director’s salary should not be contingent on the amount of fees earned by the facility.

Facilities cannot operate without permanent and well-experienced technicians. Therefore, the Directors’ financial activity should focus on securing a portion of the technicians’ salaries with the remaining portion coming from ORDA. There is also the teaching activity of each of these shops. The consistent funding for GAs should come from both the Colleges and OVCR office.

To keep these facilities active, a strategic plan for allocating the funds from different sources should also be implemented. This plan should be drafted and executed by ORDA.

4. Adequacy of Equipment and Space:

Most of the laboratory space is adequate for their current functioning, but there is little or no room for growth. All the laboratories suffer from the university’s inadequate building maintenance budget, but in most cases this problem is not yet having a major impact on the laboratories. There are two exceptions: the NMR Facility and the Animal Laboratories. The NMR Facility is cramped, has major problems with leaks from floors above the facility, and is generally cluttered. The Animal Laboratory facilities in Life Sciences II suffer from major problems with ventilation that jeopardizes the proper maintenance of the animal colonies.

The equipment in most of the laboratories is sufficient to meet current needs, but three significant challenges remain: 1) some major equipment is aging and in need of replacement; 2) nearly every facility lacks the funding for equipment maintenance contracts which results in unanticipated downtime that can be costly; and 3) there are no clear funding mechanisms for the regular purchase of new equipment that will make for more effective grant proposals.

Recommendations:

The NMR Facility space and the Animal Laboratory LSII facilities are most in need of attention. Other needs include minor renovations to Neckers 103 (for power, water, gas, and exhaust) to accommodate two new instruments for the Mass Spectrometry Facility and duct work for a fume hood in the DNA Sequencing and Allele Facility.

All the research facilities would be greatly served by two general improvements in equipment maintenance and updates: regular service contracts and a clear path for replacing major equipment. The facilities can often handle upgrades for smaller pieces of equipment, but major purchases cannot be handled through their available fee structure. The IMAGE Laboratory has a

critical need for a new scanning electron microscope that can only be facilitated via matching funds from the university (about \$150K) to support a grant proposal. *All* the facilities need equipment updates on a regular basis and equipment is often replaced only when the need is critical or the maintenance problems have severe impacts on research programs. This “crisis mode” of responding to equipment needs produces substantial uncertainty for the laboratory Directors and for the researchers who use the facilities. The development of a long-term plan drafted collaboratively among the Directors of the facilities and ORDA which addresses the eventuality of high cost instrument repairs and purchases would be helpful.

5. Directors’ Work Load and Staffing Patterns:

We found that, without exception, the Directors of the research facilities demonstrate a high level of specialized expertise and dedication to the broad research and teaching mission of the university despite being, in most cases, apparently overworked and understaffed. Of the six facilities under review, three are one-person operations (CRS, NMR, MS) and two are marginally staffed (IMAGE, DNA).

The Laboratory Animal Facility, which has eight dedicated personnel and additional student caretakers, appears to be the only sufficiently and stably staffed facility. Several of the Directors routinely are responsible for the full range of research and administrative functions associated with their facility, including: procurement, implementation and maintenance of precision equipment; research design, data collection, analysis and interpretation, training and supervision of faculty and student users, grant-seeking, account management and bookkeeping; indirect recruitment and retention of faculty and graduate researchers by providing critical research infrastructure; and outreach to local community schools and national research centers. Additionally, the DNA, NMR and MS facilities are directly linked to departments’ curricula, and all facilities provide indirect teaching through supervised training and supervision of student researchers and workers. Despite the scope and complexity of the Directors’ duties, user satisfaction surveys reported an overall satisfaction with services, citing the high degree of commitment, professionalism, and ingenuity provided by facility Directors who work overtime with little to no financial or staffing stability.

Clearly, the Directors of the various research shops play a critical and irreplaceable role in the research and educational missions of the university. Indeed, data suggest that the effectiveness of the shops can be directly attributed to the skills and work ethic of individual Directors. At the same time, there was unanimous concern articulated by users and Directors that continued understaffing, precarious funding for equipment maintenance and increasing demand for services are seriously taxing an already overextended and potentially exploitive system.

Recommendations:

The CRS, NMR, MS, DNA and IMAGE facilities must see an increase in dedicated staff in order to sustain their mission. The university needs to provide a secure financial commitment that the facilities will be supported with student workers, graduate assistantships, resident scientists, administrative assistance and equipment maintenance personnel as identified in facility self-studies or Program Review data.

Each facility should have formal procedures in place for cataloguing projects, providing ongoing assessment of user satisfaction and identifying emergent needs. These data will serve a two-fold purpose: 1) they will document the range, cost effectiveness and success of each facility's research contributions; and 2) they will provide needed recognition and visibility for facility Directors who may feel their efforts are undervalued, dismissed, or relegated to "technical support." All the research facilities and their Directors provide invaluable research and educational infrastructure for this university. Therefore, the administration will be well served by providing stable and appropriate financial and personnel support in return.

6. Visibility:

The Research Facilities obtain visibility for the University through several means. The most frequent means is the indirect method of supporting faculty and graduate student researchers in the attainment of grants. For example, one user of the Facilities has obtained three NIH grants he otherwise would not have received. Numerous grant proposals, grants, and journal articles result from the work of the Research Facilities. More direct means of being visible are through the Research Facilities themselves obtaining grants for equipment and/or faculty/staff. For example, the Mass Spectrometry Facility was recently awarded an NSF grant for the purposes of purchasing a new mass spectrometer and a staff scientist to run it. A final means of providing visibility to the University is through external contracts such as other universities (i.e. University of Miami), government agencies (i.e. Office of Mines and Minerals, Illinois Department of Natural Resources) and private companies (Sabic Innovative Plastics).

Recommendations:

It is the recommendation of the Program Review Committee that public visibility of all the Research Facilities be increased. This should include both internal (SIUC campus) as well as external efforts. This would serve several purposes: 1) to increase the use of cost-efficient research support services by SIUC faculty and students; 2) to increase the visibility at a national and international level of SIUC as a research institution; 3) to increase the potential income of the facilities; and 4) to provide a valuable service to the public at large.

One method of increasing internal visibility is to enhance the website dedicated to describing each research facility, its mission and support available, specific services with their fees, and contact information. Another method would be for the Office of the Vice Chancellor of Research (OVCR) to develop a document to summarize the above and send it to all faculty and graduate students via campus mail. A third possibility is to unify the various research facilities into one, cohesive group (e.g. SIUC Research Support Facilities) that also hold responsibility for increasing visibility. Something similar was suggested in the 1996 Program Review report, with a recommendation to hold regular facility Director meetings, who would be advised by a User's Advisory Group for each facility. Perhaps a more streamlined approach would be to develop one entity – the SIUC Department of Research Support Facilities – that would meet with one advisory council – perhaps the SIUC Research Support Facilities Advisory group.

In order to increase visibility at the national and international level, it is recommended that emphasis be placed on the cutting-edge services and research project support that is unique to each facility. This can be done via multiple venues, including but not limited to conference

presentations, inclusion in published research projects, and a focused publicity effort by SIUC aimed at specific audiences within private sector industry and other research institutions.

Included in an effort to increase visibility can be an offering of services to external entities, with fees set at current, competitive, open-market levels. A needs assessment to determine the external demand for each facilities' services should be conducted, and, if the need for such services exists, then an assessment of currently existing external agencies' fee-for-services could be implemented.

Suggestions for providing a service to the public at large include the following: 1) providing open houses and/or tours for area science teachers and prospective SIUC students; 2) offering facility services to local high school teachers to utilize in their classes; 3) sponsoring the Junior Science and Humanities Symposium; 4) ORDA offering a one credit-hour course that orients students to the facilities; and 5) ensuring that all those who recruit students to SIUC are aware of the research support facilities and include them in their recruitment efforts.

Increase the public visibility of the shops both internally and externally. In short, knowledge that these facilities exist and that they are engaged in cutting-edge research projects should be more widespread, especially amongst members of the broader university community outside the restricted group of users and their departments.

Part 2 Individual Facility Reports

The Central Research Shop

1. Functions Performed:

The Central Research Shop (CRS) is located in Engineering B55 where, in accordance with its formal mission statement, the Shop provides researchers with a state-of-the art facility "where they can have the specialized technical problems of research apparatus and equipment solved with a minimum of cost and delay." Specifically, the CRS houses equipment with the capability to "design, produce, test, modify, and repair custom equipment used to fill special research requirements as well as standard laboratory equipment." Facility services encompass machining, welding, electrical operations, specialized equipment design and modification, and computer-aided design/manufacturing. The shop supervisor also functions as "consultant to the researcher" regarding issues of equipment "feasibility, methodology, quality control, and problem-solving modes related to the physical-industrial-scientific methods of expediting research." The Shop services a wide range of faculty and student users, including, but not limited to: Chemistry, Psychology, Wildlife Research, Art and Design, IMAGE, and Engineering.

2. Effectiveness:

In addition to the user satisfaction data reported below, the survey generated many, many positive comments about the effectiveness of Mr. Moroz's services. A total of 77 comments were

made from the 14 user respondents. An overwhelming majority were positive in nature (66 of the 77 comments). Descriptors used in describing the work of the CRS included “critical,” “professional,” “expert,” and “instrumental.” Of the 12 comments that can be considered negative, three were regarding lack of space and six were regarding being understaffed. The other four comments included an expressed desire to maintain a glass-blowing facility on campus, the need for more calibration capability, and a desire for faster responses during a research emergency.

3. Need for Services:

The Central Research Shop plays a critical role in supporting a wide range of university researchers at minimal cost. Users are unanimous in praising Greg Moroz’ design and manufacturing expertise, and his commitment to providing individualized attention to each researcher. He is clearly an invaluable asset to SIUC’s research mission.

There is faculty and student consensus that no other facility on campus or in the broader community has the equipment, expertise or cost-effectiveness to provide these services. This need was addressed by asking the participants what they would do and where they would go if they didn’t have CRS services. Eight of the 14 stated they had no idea what they would do if they could not have access to the CRS. One respondent stated that the CRS is not replaceable and he would not in fact be able to conduct his research with it. Eight of the 14 respondents stated they would not know where to go, with a few stating other than St. Louis, to obtain similar services. Not one respondent was able to state a local alternative source for the same services. Of those who conjectured using an outside source, they stated they would not be able to get equivalent services, costs, or interest in the research project itself.

4. User Satisfaction:

Users agree that the Central Research Shop, under Greg Moroz’s direction, provides invaluable research support at all levels of design and manufacturing. In our user satisfaction survey, 14 out of 14 responses, from both faculty and students, were unanimous in their praise of the responsiveness, efficiency, and cost effectiveness of services provided. According to one faculty researcher in Psychology, the smoking room which Moroz designed and built has been “critically important to the success of my three recent NIH funded projects which brought approximately four million dollars to SIUC.” Other faculty accolades include: “pieces Moroz made have contributed to 3 publications and multiple international conference presentations;” “well-versed; I’m going to his shop to be trained by him;” “one of the safest shops on campus;” and “I would not be able to do the research I do without the CRS and Moroz who is incredibly helpful and professional.” Graduate and undergraduate students also benefit from the CRS and Greg’s supervisory expertise. He currently has one undergraduate student working learning computer-aided design (CAD) software; he has overseen the design and building of a precision racecar, and created “unique apparatus” for several graduate projects that allow students to “overcome dead ends in research.” Says one alumnus currently employed in mining engineering: “working in the

CRS provides an undergraduate with real world design and manufacturing experience unmatched by any specific course curriculum.”

In the past, there have been no systematic efforts to gauge or document user satisfaction. The review committee’s user survey, however, generated a 64% response rate with overwhelmingly positive assessment of the facility in general and Moroz in particular. The few negative comments cited a need for increased personnel to alleviate work overload. It was recommended to Mr. Moroz that he develop a more formal method of documenting user satisfaction.

5. Administrative Report:

Moroz reports directly to ORDA, but has a great deal of autonomy in the everyday operations of the Shop. As Senior Shop Supervisor, Greg Moroz has worked in the Central Research Shop since 1995 and been the Shop administrator and sole personnel since it moved to the Engineering Building in 1998. He currently has one undergraduate student worker funded from his own account and he has applied for an undergraduate research assistant. It was interesting that of the 14 user respondents, five stated the CRS was understaffed, 9 stated it was adequately staffed, and none stated it was overstaffed.

Moroz is a master machinist and designer who brings a wealth of professional research and design expertise to his position. One faculty researcher describes Moroz as “well-trained, creative, and 100% dedicated to high-quality craftsmanship . . . and a transparent process that involves the researcher.” In general, Moroz’s services involve an extensive process of consultation, on-site visits, apparatus design, testing, delivery and implementation in which “he goes out of his way to make sure what he makes actually works.” Moroz divides his time between billable hours, maintenance and modification of equipment, and administrative duties such as billing accounts, tool acquisition and client consultations.

6. Cost Effectiveness:

The sole ‘operating budget’ for the CRS is a 3-account comprised of user fees generated by Moroz’s work. From this account, he purchases the necessary shop tools, all the computers used in the shop as well as funding the student worker. Despite the absence of an oversight budget, Moroz has maintained an industrial grade shop, largely through his resourcefulness in purchasing and design modifications to outdated equipment.

Users fees are \$20 per hour plus the cost of materials. Moroz does not charge for time spent in consultations or design, although users report an extraordinary degree of time-intensive, individualized attention given to each project. Eleven of the 14 respondents stated the fees were reasonable, with four of those describing costs as “extremely fair” or “extremely reasonable.” Based on this data, it appears that a significant amount of Moroz’ (over)time is spent working for free, although he reports that user satisfaction and his own creative energies balance the lack of monetary compensation.

By all accounts, the CRS services are highly cost effective; one user reports that were these services outsourced to the community, the fees would be doubled, without including the individualized design consultation and testing currently provided by Moroz. Anecdotal data further suggests that Moroz's modifications to existing research apparatus saves the university tens of thousands in comparison to the cost of purchasing new equipment.

7. Status of Available Equipment and Space:

The Shop has three pieces of industrial grade equipment: a Haas CNC Toolroom Mill, a Deckel FP2 Toolroom Mill, and a Monarch EE Toolroom Lathe. The Haas Mill is reportedly the only functioning precision instrument of its kind available on campus. The Deckel Mill and Monarch Lathe are both old models, circa 1968, which Greg has resourcefully modified with digital readouts and other upgrades suitable for high-tech design and manufacturing. One respondent stated it would be an improvement if the CRS had more modern CAD milling machines. Additionally, the Shop has a wide range of specialized hand tools, drills, etc that Moroz has purchased over time for use on specific research projects. Moroz would like funding to purchase a new Haas Lathe to replace the antiquated model; the anticipated cost of the new lathe is \$40,000.

In 1998 the CRS relocated to Engineering B55; the new facility seems to have facilitated significant expansion of its equipment and services. Two of the 14 respondents noted he could use additional space, especially for storing of bulky welding, grinding, and fabricating materials. Seven others stated the shop seemed to have adequate space. The remaining 5 respondents had no comment. The Shop is exceptionally neat, clean and organized despite multiple ongoing projects on site. Moroz has been particularly resourceful in the acquisition of a wide range of specialized tools, often at deeply discounted prices, from funds generated by user fees. He conducts maintenance, repair, modifications and upgrades to all equipment, including designing and manufacturing parts for a specialized duct system commensurate with the unique safety protocols of the machinery.

8. Suggested Means to Improve the Operations:

The primary concern at this time is extended and reliable funding during this time of financial strain, such that money for equipment, computers and student workers does not deplete Mr. Moroz's self-generated operating budget. It is recommended a budget in which Mr. Moroz has the authority to decide which monies he will spend and which monies he will save for future needs be implemented. At the very least, a permanently funded student worker or research assistant would significantly ease the budget concerns and lighten the workload while preserving the autonomy of the shop supervisor.

Secondly, the shop needs a new Haas Lathe to replace the older, currently utilized lathe, and additional CAD/CAM software to continue to provide a high level of service to the SIUC community. The Hass Lathe costs approximately \$40,000 according to Mr. Moroz. Once

purchased, without any unforeseen equipment failures the CRS should be able to operate at the current level for several years.

Additionally, the reviewers are concerned that Mr. Moroz conducts a great deal of unpaid, overtime labor and perceives he receives little or no recognition or visibility, despite providing essential equipment infrastructure for many high visibility grant-funded research projects. It is suggested by these reviewers that Mr. Moroz receive a regularly conducted review of research projects he supports or facilitates, and that a formal method of acknowledging his accomplishments be established.

IMAGE Center

1. Functions Performed:

Dr. John Bozzola has been Director of the facility for 25 years. The IMAGE Center serves a wide range of users and provides a variety of services. They provide transmission electron microscopy, scanning electron microscopy, light microscopy, sample preparation (for microscopy), graphic design and illustration, photography services, and poster preparation. During Dr. Bozzola's tenure, the IMAGE facility has shifted from serving primarily the medical school (40% of users) to serving a greater proportion of materials users. Very few (10%) of the users are from outside of the university.

2. Effectiveness:

The result of our user survey indicated high satisfaction with the current services provided given the current equipment and staffing constraints. The staff was judged to go above and beyond its duties to help users to meet their goals. The current staff was described as "pleasant," "knowledgeable," "helpful," "dedicated", and "excellent troubleshooters."

Nearly every user judged the Center to be understaffed. Some expressed a desire for more staffing during critical periods (e.g., when conferences were imminent and poster printing is at a premium). Some users commented on the short staffing and their "guilt" about how much extra time (e.g., weekends) that the staff were committing in order to meet their project needs.

3. Need for Services:

By all counts, IMAGE's services are extremely valuable to the research mission of the university. Users were very vocal in support of its services ("absolutely critical," "major contribution"). In its absence, researchers would have to go to the University of Illinois for microscopy services at a considerable increase in cost, inconvenience, and (in some cases) would prevent funded research programs from functioning (e.g., those labs that have daily microscopy needs). IMAGE's photography services are often quite specialized and likewise not readily available locally. Finally, although poster printing is available from local printing services, users

consistently lauded IMAGE's staff for their helpfulness, skill, patience, and ability to provide services on short notice. Students appreciate the cost savings over what they would pay commercially because IMAGE's staff is able to prevent a lot of problems before the posters are printed. Researchers' ability to produce professional, timely, and cost-effective posters has served to improve SIUC's image at scientific conferences.

Some materials-related researchers expressed a need for access to additional instruments not currently available at the Center. These needs are currently being met by outsourcing the work to the University of Illinois.

4. User Satisfaction:

Addressed in "Effectiveness" section.

5. Administrative Cost:

The facility is funded by ORDA (which covers most of the salaries) and user fees (which covers all other costs including supplies, parts, maintenance contracts, telephones, and some equipment upgrades). In addition to the Director, the facility also employs three full-time staff (Scientific Photographer III, Graphic Designer II, Electron Microscope Technologist II) and one part-time staff (Associate Scientist, 40%).

6. Cost Effectiveness:

The current cost structure was judged favorably by researchers and students. Any significant increase in costs would have a detrimental impact on the research productivity of faculty and students. Outsourcing is often prohibitively expensive and the current costs help SIU's scientists to remain competitive with major research institutes. Student projects would be the first area cut if costs were increased, thus negatively impacting SIUC's teaching mission. Very little of the Center's funding is generated by outside contracts.

Dr. Bozzola's creativeness in covering costs within his current constraints is commendable. He has pursued external funding for new equipment when feasible and has even purchased new equipment on eBay when possible. The Center is a lean and efficient operation, which is one of the primary reasons why any additional cuts (especially to staffing) have been felt so acutely. Any additional cuts or a failure to replace lost staff will most likely result in a scaling back of the teaching services provided by the Center. Teaching is *very* much appreciated by users but was not judged to generate sufficient cost-recovery by the Center's Director to justify its continuation in light of current budget constraints.

During the preparation of this report, Dr. Bozzola has had to make the difficult decision for IMAGE to stop teaching two graduate courses, SCI 501 (TEM) and SCI 502 (SEM). These cancellations were a direct result of insufficient staffing, too much use of the aging SEM machine and a desire to stretch the life of the apparatus, and a resulting focus on teaching only those students who most need it (who will need to pay for training on an hourly basis, \$25/hour).

7. Status of Available Equipment and Space:

The current space appears sufficient for the next few years. Although there was an expressed need for more storage space, the need does not appear critical.

The IMAGE Center needs to replace its 25-year-old SEM, and Dr. Bozzola is more than willing to pursue external funds to do so. The SEM is the most heavily used equipment at the Center but will cost \$600,000 to replace. They have a team assembled for writing the proposal but have refrained from doing so due to the need to have 30% in matching funds from the university. Although IMAGE could generate about one-fourth of those funds, they need an additional \$150,000 from the university before they can proceed. Departments are not in a position to make a significant dent in this need, so central administration needs to step in to fill this gap.

Materials users expressed a need for a range of additional upgrades to the variable pressure SEM, Atomic Force and Scanning Tunneling microscopes, and High Resolution TEM in order to insure that SIUC is at the leading edge in competitiveness for national grants.

8. Suggested Means to Improve Operation:

Some of the services that IMAGE provides are also provided by another unit on campus. The SIU Medical School has developed its own facilities for light microscopy and is expanding its microscopy capability. This move was not deemed a duplication of effort on campus but rather as meeting the growing needs of the SIU Medical School. However, there is a need to insure that undue duplication is avoided and thus consistent communication among the units is necessary.

The Center's recent move to cancel SCI 501 and 502 was necessary and will focus their efforts on training those students who will use the instruments for research purposes. They no longer have the luxury of training students who simply want to obtain research skills that *might* be useful at some point in the future. Although this decision may make it difficult to recruit students to certain majors (who will no longer have the luxury of obtaining TEM and SEM skills that are not being directly applied to a research project), it is a necessary one. However, given that this change only recently took place (April, 2009), the review committee has not been able to assess the reaction of the user community to the future unavailability of these courses.

Dr. Bozzola has demonstrated an admirable willingness to solve as many of the challenges that the facility faces using the Center's own resources and to seek resources external to the university where available. He recently served as PI on a successful NSF grant that funded a much-needed upgrade to an aging TEM. There remain some areas of critical need, however, that will require at least some assistance from the university. These challenges are fully discussed in the IMAGE Center's recent self-study (attached as an Appendix) and summarized below.

Staffing needs

A *critical* need is the salary support to fund the Associate Scientist position at the 100% level to support the microscopy functions at the Center. IMAGE has had to absorb budget cuts that are

endangering the unit's effectiveness. Due to the presence of dedicated staff that are donating extra time to meet needs, the facility has maintained its functionality but this situation cannot continue. Sooner or later, this staffing shortfall will result in the cutting of services. The most likely cuts will affect the Center's contribution to student development because teaching TEM and SEM classes are not cost effective (these services were recently cut, April 2009), serving on committees provides no income, and student projects generate insufficient funds to cover equipment use. A similarly important need is to provide appropriate and regular raises to Hilarie Gates (the EM Technologist) in order to retain her critical skills.

Computer support for website development and training on site maintenance

This need is short-term but will greatly enhance the Center's visibility on- and off-campus thus helping in the recruitment of students, faculty, and external customers. Although the Vice Chancellor for Research recently provided funds to upgrade their computer equipment, it is being under-utilized due to a lack of IT support. As their self-report states, "we are microscopists, not IT specialists" and thus they lack the skills to maximally integrate the new equipment in order to fulfill its potential.

Laboratory Animal Facility

The Laboratory Animal Program (LAP) at Southern Illinois University Carbondale (SIUC), with facilities in the Life Sciences II and III buildings, is responsible for all aspects of research and care involving vertebrate animals. Program staff includes a Director/Veterinarian, Coordinator of Laboratory Animal Care, Office Manager, four full time Laboratory Animal Technicians, one part time Technician, and a number of Student Caretakers. The LAP is accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC) maintains compliance with the federal Animal Welfare Regulations and Public Health Service *Policy on Humane Care and Use of Laboratory Animals*.

1. Functions Performed:

Essentially, the LAP performs the enormous array of functions involved in the procurement and care of all the vertebrate animals used in the many and varied kinds of bio-medical research carried out at SIUC. These include specialized husbandry and technical services, clinical and surgical veterinary services, pathological support and serological evaluations, individual and web-based training for individuals involved in all aspects of animal care and research, health surveillance, vendor surveillance and quarantine, environmental monitoring, protocol development and consultation, animal model development, and orientation services for staff and researchers.

2. Effectiveness:

When evaluating the effectiveness of the LAP (or any comparable facility that provides the basics needed in order to carry out research), there are two broad areas to be considered. First there is the effectiveness of the work done in the facility itself – in this case, the economy of procurement, the efficiency with which the facility is run, and, most importantly, the quality of care given to the animals. Second, regardless of how well the facility is run, it is effective to the research mission of the university only insofar as it facilitates the research procedures of the users. On both counts, the LAP at SIUC is doing very well.

There is a good deal of oversight in regard to the manner in which the LAP is run and to the care given to the animals. This side of its effectiveness is formally evaluated every three years by the Association for the Assessment and Accreditation of Laboratory Care International (AAALAC), and, indeed, continued accreditation for the LAP is dependent upon AAALAC approval. As a consequence of the AAALAC's latest site visit in 2007, not only was full accreditation for the LAP continued, but recognition of the quality of the facility was noted. In his letter to Dr. Scimeca, LAP's Director, the President of the AAALAC's Council on Accreditation, Dale G. Martin, made the following observations: "The Council commends you and the staff for providing and maintaining a quality program of laboratory animal care and use. Especially noteworthy were the excellent husbandry and cleanliness of the facilities, as well as the clear institutional commitment to employee safety." This speaks well for Dr. Scimeca and the entire LAP staff. It is important to note that the AAALAC is considered the highest international standard of accreditation.

In regard to the productivity of the researchers who use LAP's services, short of providing a list of every book, article, and presentation by every user complete with critique and evaluation of them all, suffice it to say, for purposes of this report, that they services provided by LAP are effectively promoting the University's research mission.

3. Need for Services:

The need for the LAP is crucial to the University's research mission. This would change only if the University's administration were to decide, incomprehensibly, that all research utilizing animals was unnecessary to that mission. As long as that does not happen, and presumably it will not, then the need for LAP's services is vital. In addition, the LAP provides an important tool to recruit and retain highly qualified investigators by providing outstanding veterinary care and services.

4. User Satisfaction:

As implied above, for people who use this facility, the presence of the LAP at SIUC is absolutely necessary to their being here and staying here. Without it, all would find employment elsewhere. The facility is used for faculty members' own research projects, but they also mentioned that it plays a critical part in the learning process for undergraduates, grad students, and post-doc fellows.

According to the users who responded to our survey, the major strengths of the facility include the excellent care given to the animals, and the overall excellence of the staff in general which is seen as professional, knowledgeable, and helpful. Users also indicated that the LAP is an essential component of student learning and training at the undergraduate and graduate level, with regard to bio-medical research and animal models. Furthermore, the facility appears to be large enough and well equipped enough to allow faculty to carry out their own research projects with minor problems only.

One of those problems, however, is the need for physical improvement of the heating, cooling, and ventilation system. It was mentioned that some of the animals are occasionally “stressed out” because of the heat and humidity during warmer times in Carbondale. There was also some concern for the emergency electrical system, which may not be adequate. General upkeep and repair of the facility seems to be needed.

5. Administrative Costs:

The costs of running the LAP are met by two general sources: first, there is direct administrative support from the university, and second, researchers pay a per diem charge for the overall care of the animals. There is agreement between the administration and users that a 50-50 split of these costs is appropriate, which is approximately what they are now. Respondents to our survey of users noted satisfaction with the current fee structure, mentioning that the fees for per diem and vet services are below national and regional norms. On the other hand, it was also mentioned that the administration’s proposed fee structure was “outrageous.” This comment led to the suggestion that a faculty oversight committee consisting of vivarium users should be constituted, that the balance of committee members should reflect the different species of animals used, that they have access to the complete budget, and that they review any proposed fee changes in the light of their understanding of the differing needs of various researchers.

6. Cost Effectiveness:

Given the fact that the LAP maintains an excellent reputation with the AAALAC, that it carries out its work with an appropriate balance between administrative support and service income, and that it does so with per diem charges that are slightly below the norms at comparable universities, it must be concluded that the cost effectiveness of the funds spent for its operation is high.

7. Status of Available Equipment and Space:

The facility is housed in Life Sciences II and III with approximately 25,000 square feet of combined space, including the enclosed hallways between LS II and III. Currently, there is sufficient space for the LAP to carry out its mission effectively, but that may change. The facility is running at about 85% capacity which means there is limited space available for current researchers, but, more crucially, additional investigators coming to SIUC may cause some

difficulties regarding appropriate access to the facility space and resources. It would be possible to increase available space up to 25% through the purchase of new ventilated racks, but they cost \$25,000 a piece, and, currently, capital funds are not available for such purchases.

8. Suggested Means to Improve the Operation:

Clearly, the most dire need for the LAP is for the physical improvement of the heating, cooling, and ventilation systems as well as other structural improvements to the buildings involved. As everyone at the university knows, this problem is hardly unique to the animal facilities. One survey respondent mentioned that some of the animals are occasionally “stressed out” because of the heat and humidity during warmer times in Carbondale. There was also some concern for the emergency electrical system, which may not be adequate.

The focus of concern is on the Life Science II building. Both Dr. Scimeca and Dr. Pru Rice have submitted grant proposals to acquire federal funds for the repair of Life Science II, but thus far those efforts have not been successful. The reviewers encourage continued efforts to secure funding, particularly in light of current federal stimulus money available. Specific needs include new air handlers, a new floor in the vivarium area, increased security apparatus, a monitoring system that would report temperature and humidity data to the physical plant directly and electronically, and, as implied above, improvements to the heating, cooling, and humidification systems. At least (some of) the users have been able to keep their sense of humor about the situation. In response to our question on the survey about safety concerns regarding maintenance and use of the lab, one respondent said, “other than sweating to death when LSII and LSIII go through crazy transition temperatures, not really.”

Additional equipment, such as ventilated racks and automated water systems, may reduce the total cost of operations by reducing labor costs, thus keeping per diems within reasonable rates. Installation of a card access system for lab rooms is also recommended as a security improvement.

Mass Spectrometry Facility

Overview

The Mass Spectrometry Facility provides expertise in mass spectrometry to all SIUC researchers as well as to outside customers. This expertise includes the analysis of organic compounds ranging from small molecules to large biological molecules. To accomplish the research objectives, the Facility maintains a wide inventory of routine and cutting-edge mass spectrometers. The Mass Spectrometry Facility is located in Neckers Hall in room 103, which houses the Facility’s instruments, and room 110, which serves the Facility’s wet lab. The Facility was established in September 2006 with two sources of funding. The first was a National Science Foundation grant (award #0405819) for \$180,256 that was won by principal investigator David A. Lightfoot (Plant, Soil and Agricultural Systems) and co-principal

investigators Edward J. Heist (Fisheries & Illinois Aquaculture Center), Luke Tolley (Chemistry & Biochemistry), Jianjun Wang (Biochemistry & Molecular Biology), and Andrew Wood (Plant Biology). The second source was Office of the Vice Chancellor for Research (OVCR), which provided \$76,000 in matching funds.

The Facility is part of the Department of Chemistry & Biochemistry and is directed by Dr. Mary E. Kinsel. Dr. Kinsel has a 50% appointment in the Facility, with that portion of her salary funded by ORDA. As Director, Dr. Kinsel has administrative, research, and teaching responsibilities. Through the Facility, Dr. Kinsel serves a wide variety of SIUC researchers from multiple units on campus, thereby supporting the research missions of the College of Agricultural Sciences, the School of Medicine, and the College of Science. She also conducts hands-on workshops on how to use the equipment and regularly lectures in graduate and undergraduate classes, thereby supporting the teaching missions of the relevant units. The Facility also accepts contracts from other academic institutions, private businesses, and governmental agencies.

The remaining 50% of Dr. Kinsel's appointment is in the Chemistry & Biochemistry Department where she holds the rank of lecturer. Her course rotation includes classes in general chemistry, analytical instrumentation, and forensic chemistry.

1. Functions Performed:

The Facility has both research and educational functions. Dr. Kinsel serves as the Facility's sole administrator, resident scientist, and instructor. As Director of the Facility, Dr. Kinsel is responsible for the Facility's oversight and operation. As the Facility's resident scientist, she acquires data for other researchers, collaborates with researchers using the instruments, conducts research, and oversees the use of instruments by researchers and graduate students.

As the Facility's only instructor, Dr. Kinsel trains doctoral students using the instruments as part of their graduate assistantships or dissertation research. She provides hands-on workshops, teaches short courses, and demonstrates the correct use of the equipment. Dr. Kinsel provides hands-on instruction for students in Chemistry 351 and 536, and team-teaches Chemistry 434 and 439. Each semester, she is the teacher of record for Chemistry 200, and receives positive feedback regarding her effectiveness as a lecturer. Instructional uses of the Facility will increase given the implementation of new classes in biochemistry, geology, plant biology, and zoology.

Because the Facility has no technician, Dr. Kinsel performs routine maintenance on the instruments and, when problems arise, she contacts the relevant company's technical support services and trouble-shoots problems, which may necessitate extended and repeated contacts by telephone. Because the Facility has no clerical or sales staff, Dr. Kinsel also responds to inquiries regarding the Facility's services, solicits external clients, prepares costing quotations, monitors accounts payable, collects all monies owed, and answers the telephones.

Dr. Kinsel states that her work for the Facility exceeds the 20 hours per week required by her 50% appointment.

2. Effectiveness:

Dr. Kinsel is clearly an effective administrator, scientist, technician, teacher, and trainer. Here, we focus on her effectiveness in terms of the Facility's research and teaching missions. We take each activity in turn.

We begin with teaching and training at the Facility. Dr. Kinsel interacts regularly with graduate student-users. She has trained eight graduate students to use the instruments, thereby providing significant support for graduate programs in Chemistry and Biochemistry, Molecular Biology and Biochemistry, Physiology, Plant Biology, Microbiology and the Cooperative Wildlife Research Laboratory.

The Facility is also involved in undergraduate teaching. Over the last two years, Dr. Kinsel has trained and mentored three undergraduate students through the NSF REU Program. Over the last three years, she has also secured undergraduate assistantships focused on the analysis of veterinary pharmaceuticals for three students. Among the six students thus served, three are pursuing graduate studies and one is applying for graduate school. Taken together, this indicates Dr. Kinsel's effectiveness as a teacher and mentor, which suggests that the Facility provides an excellent educational experience to its undergraduate student-users.

As noted above, Dr. Kinsel provides hands-on instruction in mass spectrometry for Chemistry 351, 434, 439, and 536 and lectures in Chemistry 200. She has received positive feedback regarding her effectiveness as a lecturer.

We also observed four interactions between Dr. Kinsel and individual students before and after our second meeting with her. Two students, apparently undergraduates, consulted her regarding class assignments. In each case, Dr. Kinsel knew the students' names, listened carefully to their concerns, identified and answered their questions. Her demeanor combined accessibility and respect for students while challenging them to master the material. We also observed brief interactions with a female graduate student, who was bringing her baby into the lab where the student was scheduled to work, and a male graduate student, apparently an international student, who was working when we arrived. In both cases, Dr. Kinsel was professional without being formal, clearly knew the nature of the projects underway, and just as clearly held them to high standards. All four students obviously respected her, felt at ease with her, and appreciated her expertise. These observations suggest that Dr. Kinsel effectively serves a diverse population of students, both graduate and undergraduate, and that she is clearly a role model.

On these bases, we conclude that the Facility is highly effective in fulfilling its teaching mission due to Dr. Kinsel's expertise, skill as a teacher, and openness to student diversity.

The Facility operates as a service facility, but there is a significant component of collaborative research, as well as training for faculty, postdocs and graduate students. As the research mission is concerned, MS Facility participates in several research projects and also Dr. Kinsel is involved in a few research projects. Projects range from simple sample analyses without need for further

assistance to long term collaborations involving significant consultation, sample preparation and data analysis. Past and current projects include: (1) the application of MALDI TOFMS to the characterization of complex protein mixtures separated by dynamic isoelectric focusing, (2) the characterization of depolymerized suberin using GC-MS, (3) the quantitation of PCB's bio-accumulated in turtles, and (4) the development of methods for the characterization of novel polymers by MALDI MS.

3. Need for Services:

The need for the Mass Spectrometry Facility's services is very strong. The Mass Spectrometry Facility provides modern instrumentation and expertise for mass spectrometric and chromatographic analyses as well as provides information pertaining to the molecular weight, elemental composition, and molecular structure of a compound. The Facility has state-of the art instrumentation that can be used either directly by users or by Facility staff for the analysis

Research use of the Facility is expected to increase. Undergirding this expectation is the acquisition of a new mass spectrometer funded by an NSF MRI grant. Tied to this grant is the hiring of a staff scientist. The acquisition and hiring should be completed in Spring 2009. While the staff scientist is specifically tied to the new instrument, Dr. Kinsel hopes to find an individual who will integrate her/himself into the Facility's various operations.

We can expect continued demand from Chemistry and Biochemistry, Molecular Biology and Biochemistry, Physiology, Plant Biology, Microbiology and the Cooperative Wildlife Research Laboratory for graduate student training on the instruments. Similarly, the NSF REU program's support for training and mentoring of undergraduates, coupled with Dr. Kinsel's participation in that program, should continue attracting talented undergraduates to the Facility. Finally, we can expect continued demand for the Facility's instructional services in Chemistry 200, 351, 434, 439, and 536.

4. User Satisfaction:

We have contacted users with the Research Facility Survey. We received 2 surveys back and also spoke to a few other users that did not send the surveys. Users give Dr. Kinsel high marks for her knowledge and willingness to assist in various projects. One user stated that the MS Facility has been very important to their productivity, because they do not have such instrumentation in their lab. Also, this user stated that Dr. Kinsel has assisted her with instruments set-up and answer any questions that she had after training. The other user stated that the MS Facility is understaffed, since Dr. Kinsel appears to be the only one to juggle everyone's schedules amongst her classes. Users stated also that the Mass Spectrometry Facility provides good service and the Facility is well managed. Additionally, the survey says that the instrumentation in the Facility is up to date and the Facility Director is very helpful. As the cost of the service is concerned, users pointed out the fair pricing for the service. The Facility supports the research missions of the College of Agricultural Sciences, the School of Medicine, and the College of Science. The

Facility has served researchers from the Departments of Animal Science; Biochemistry and Molecular Biology; Chemistry and Biochemistry; Forestry; Geology; Microbiology; Physiology; Plant Biology; Plant, Soil, and Agricultural Science; and Zoology. Services have also been provided to SIUC's Cooperative Wildlife Research Laboratory and Meyers Institute for Interdisciplinary Research in Organic and Medicinal Chemistry.

Besides serving SIUC, the Facility contracts external customers to analyze samples, charging higher fees for this service. Dr. Kinsel is proactive in seeking external clients. Among external clients who are repeat customers is the private company SABIC, which has a continuing research project with the Facility, and the University of Miami, which has had a total of 54 samples analyzed by the Facility and anticipates sending others in the future.

In Appendix B of the Facility's "Executive Summary" (Kinsel, 2008) it identifies the following institutions that are current or potential outside users of the Facility.

Department of Rheumatology, School of Medicine University of Miami;

Department of Chemistry and Biochemistry, University of Maryland, College Park, Maryland;

Harbor Branch Oceanographic Institute, Department of Aquaculture, Florida State Atlantic University, Boca Raton, Florida

The summary identified two corporate and one governmental client, respectively:

Sabic Innovative Plastics, Mount Vernon, Indiana; Froggy's Fog, Columbia, Tennessee;

Office of Mines and Minerals, Illinois Department of Natural Resources.

Dr. Kinsel's report states: "To date, this high level of usage has evolved without any active recruitment of users of the Facility" (SIUC Mass Spectrometry Facility Activities Summary, p. 4, December 18, 2008.)

A concentrated campaign targeting likely users could well increase the Facility's income but would require a considerable expansion of staff beyond Dr. Kinsel and the single scientist whose hire is tied to a particular instrument and who will be sought in spring 2009's search.

5. Administrative Costs:

Dr. Kinsel has a 50% appointment in the Facility, with salary funded by ORDA. As Director, Dr. Kinsel has administrative, research, and teaching responsibilities. She also has a 50% appointment in the Chemistry & Biochemistry Department, for a total salary of \$48,000.

The Mass Spectrometry Facility has no operating budget. All the funds are coming from the users' fees and are deposited into two accounts – one account for on-campus activities (BP

200035) and the other for off-campus activities (BP206576). The Facility's expenses for chemicals, laboratory supplies, instrument maintenance and repair are supposed to be covered by monies earned through providing services to SIUC researchers and external contractors. Although these earnings have been sufficient to cover chemicals and laboratory supplies, they cannot begin to cover instrument repairs. For that cost, the Director has solicited matching funds from OVCR, the Office of Research Development and Administration (ORDA), and the Chemistry & Biochemistry Department.

The Chemistry & Biochemistry Department assists the Facility by having Terry Christian order chemicals and supplies for the Facility, and assigning Chris Kraft to receive them.

6. Cost Effectiveness:

The Facility appears to be cost effective in the sense that personnel costs have been minimized by limiting personnel to a single, 50% appointment. As Dr. Kinsel notes, her work load in the Facility requires more than the 20 hours per week allotted in the part-time appointment. Given the increase in demand for services connected with the new spectrometers, the addition of a staff scientist will not substantially free Dr. Kinsel to focus more on administration, the Facility's research mission, or conducting outreach to external clients.

7. Status of Available Equipment and Space:

Currently, the Mass Spectrometry Facility has four mass spectrometers, three of which were purchased in 2005 and the fourth purchased in 2008. Specifically, the Facility has a:

ThermoFisher Trace Ultra GC/ Finnigan PolarisQ Mass Spectrometer

Bruker Daltonics Microflex Time-of-Flight Mass Spectrometer

Applied Biosystems Inc. 4700 Proteomics Analyzer

Bruker Daltonics Esquire HCT.

One of the instruments was purchased used and its manufacturer has announced that replacement parts will no longer be available in 2010. With the economic downturn, parts suppliers have been minimizing inventories, only ordering parts from the manufacturers after receiving orders from the Facility. There seems to be no support for the Facility ordering replacement parts before an instrument fails. Without such support, the time lapse between the ordering and delivery of replacement parts seriously impedes the work of the Facility. Eventually, of course, all of these machines will need to be replaced. It is unclear what plans have been made in ORDA or the OVCR regarding this matter.

In 2009, the Facility should receive a new mass spectrometer. an Isotope Ratio Mass Spectrometer (IRMS) acquired using funding from the NSF MRI program. Minor renovations of Neckers 103 (for power, water, gas and exhaust) will be required to accommodate the new instrument. After installation of the new instrument, no space in Necker 103 will be available

The Facility also has two stand alone computer work stations used both in research and instruction to process, analyze, and display data.

8. Suggested Means to Improve the Operation:

A.) Change the Director's appointment from 50% to 100% with the Facility and adjust the Director's salary so that it is commensurate with director salaries of comparable non-profit or academic facilities nationwide. Such salaries are generally within the \$65,000 to \$75,000 range. Dr. Kinsel's instructional duties within the Facility's mission are sufficient for her to retain her status as faculty.

B.) Establish an operational budget for the Facility. All of the Facility's expenses (including chemicals, laboratory supplies, instrument maintenance and repair) are currently paid by funds collected from services provided to SIUC researchers and external contractors. These funds cover only chemicals and laboratory supplies. They cannot begin to cover instrument repairs. To date, instrument repairs have been covered by soliciting matching monies from the Chemistry & Biochemistry Department, ORDA, and the OVCR

C.) Establish instrument service contracts to minimize instrument down time and minimize delays in the Facility's completion of its research duties. This would improve the Facility's ability to serve SIUC researchers and external contractees as well as freeing Dr. Kinsel from the days (sometimes weeks) devoted to telephone consultations with service engineers. To remain effective in its research mission, the Facility needs to provide quick service to SIUC researchers and external clients. Similarly, for its teaching mission, the Facility needs to provide quick turn-around times so that graduate students can make reasonable progress towards their degrees.

D.) Hire sufficient technical staff to support the Facility's mission. Routine instrument preventative maintenance as well as sample preparation and analysis could be performed by a trained technical staff support person. This would allow Dr. Kinsel to increase educational activities, engage in novel research through collaborative projects, and promote the Facility to the SIUC campus.

Nuclear Magnetic Resonance Facility (NMR)

The Nuclear Magnetic Resonance Facility is a centralized lab for research and teaching located in the basement of Neckers. It has three Varian high-field multinuclear spectrometers, an Inova 500, a Mercury *plus* 400, and an Inova 300 wide-bore. The Facility is directed by Dr. William C. Stevens who maintains the NMR instrumentation, trains faculty and graduate students in their

use, consults with and provides assistance to researchers with NMR experiments, and singly manages the day-to-day operations of the Facility. The Facility is used for synthesis of organic compounds, to determine chemical composition of compounds, for checks of “purity”, and to study protein structures and dynamics.

Dr. Stevens is clearly dedicated to the optimal functioning of the NMR Facility. He is interested in advancing the use of the Facility for the teaching mission of the university through mentoring students as well as through direct teaching and on-line courses at the graduate and post-doctoral levels.

Dr. Stevens indicated during our interview that he is often present at the Facility on weekends and holidays, and reports that he has not been able to take a vacation for 12 years since there is no other staff to manage the Facility in his absence. He has experienced health issues over the past few years that have caused his absence from the Facility. These health problems have been characterized by his physician as work-related, and yet Dr. Stevens continues to work as much as he can without taking extended sick leave. Not surprisingly, Dr. Stevens reports that he needs additional staff support so that he can focus more fully on the research capabilities of the NMR Facility rather than on the physical maintenance duties.

1. Functions Performed:

The instrumentation and software of the Nuclear Magnetic Resonance (NMR) Facility are used in order to support a wide variety of research projects, primarily within the disciplines of chemistry, biochemistry, and materials exploration. The functions carried out through the use of the NMR instruments are key elements in innumerable research projects in all these disciplines. Projects that utilize nuclear magnetic resonance spectroscopy are center stage in a large portion – if not most -- of the meaningful and cutting-edge research being undertaken in these areas of scientific inquiry.

At SIUC, faculty researchers in the appropriate disciplines are principal users of the NMR Facility although faculty members apparently rarely operate the instruments themselves. It is also routinely used by undergraduates in addition to grad students and post-doc fellows. In fact, use of the NMR Facility has been integrated into the undergraduate chemistry curriculum itself, and is thus now a part of several undergraduate as well as graduate courses. This is clearly the wave of the future as evidenced by the most recent guidelines supplied by the American Chemical Society in their description of an excellent undergraduate program. Such a program, they said, “should incorporate into the curriculum several pieces of sophisticated equipment suitable for undergraduate instruction and research. One of these **must** be an NMR spectrometer.”

In short, not only does the NMR Facility enable faculty researchers to carry out their investigations in line with the University’s research emphasis, it also enables the University to maintain excellence in teaching – at least in the undergraduate chemistry curriculum.

2. Effectiveness:

As long as the NMR Facility has the resources to maintain its instrumentation and software, and to acquire new equipment as needed, it is extremely effective in its support of faculty research projects. It also helps the University maintain its accreditation with the American Chemical Society for our undergraduate and graduate degrees in chemistry. Finally, while it is difficult to precisely measure effectiveness in helping to recruit and keep first-rate faculty and students, a well-maintained NMR Facility clearly helps. The lack of such a facility would be an equally clear liability.

3. Need for Services:

The NMR Facility provides essential support for a comprehensive university that places a high priority on research. There are a small number of users of the NMR Facility; however, the Facility is what keeps these users at SIUC and not somewhere else. There is an elemental and crucial need for the services provided by the NMR Facility for faculty and students within the relevant academic disciplines – i.e., chemistry (especially organic chemistry), biochemistry, and materials. Without the Facility, SIUC would lose its accreditation for the undergraduate and graduate degrees in chemistry, and would doubtless lose the capacity to attract and keep first-rate faculty and students. Use of nuclear magnetic resonance spectroscopy is now basic to serious research endeavors in the field. This fact was recognized long ago by the University administration when it established the NMR Facility at the Carbondale campus in 1987, and no one argues that we can get along without it.

The nearest facility for high resolution NMR spectrometry is Washington University in St. Louis. Thus, maintenance of the NMR Facility is essential for the recruitment and retention of outstanding faculty and student researchers who will further the research mission of SIUC.

4. User Satisfaction:

The evaluation of user satisfaction comes from information obtained from the four faculty and four student users who responded to our survey. All of those responding reported the critical role the NMR Facility plays in their research and scholarly productivity.

Most of the respondents are delighted with the collection of state-of-the-art NMR magnets and spectrometers, but note that they are seldom all running properly at one time. Students value the assistance of Dr. Stevens, the experimental detail provided by the equipment, the opportunity to conduct solids research, and the ease with which the equipment can be used. Faculty noted the important role the Facility plays in providing essential hands-on experiences for students learning to interpret data and make decisions for their own research.

Both faculty and students are frustrated about equipment that is frequently not working or has not been fully installed, such as Dell computers purchased for use with the spectrometers and the solids installation, because the fiscal resources are not available. Eighteen-month interruptions in research productivity have occurred because of needed equipment repairs. One faculty user commented that Dr. Stevens has been very helpful in straightening out malfunctioning instruments, often over the weekends.

When we asked users about staffing needs of the Facility, there was a definite thread running through their responses. The Director is characterized as often absent from the Facility, more recently due to physical ailments and health issues. These absences have negatively impacted equipment maintenance, effective communication between users and the director, student training, etc. Both faculty and student users reported that when the Director is present and in better health, he is very helpful and effective, particularly with students.

One respondent indicated the need for more training for faculty on the instrumentation. Another suggested the creation of a course(s) to provide a thorough training process for students and new users.

5. Administrative Costs:

After the acquisition of the instrumentation, the principal administrative costs of operating the NMR Facility revolve around the care, maintenance, upkeep, and upgrading of the equipment, and the salaries of the personnel involved. Initially, the Graduate School, the School of Medicine, and the College of Science shared equally in the repair costs, travel expenses, and other financial needs of the Facility, except that 50% of the salary of the Director was paid by the Graduate School, and 50% by the School of Medicine. In 2005, after the departure of Dr. Jianjun Wang, the School of Medicine discontinued its support of the Director's salary, which meant that either the Graduate School would be required to pick up the entire salary line for the Director, or an alternative way of funding the other 50% of the Director's salary would have to be found. The alternative that was chosen, presumably as a stop-gap measure, was to take those funds from the Facility's Overhead Recovery Account (ORA), but these monies come entirely from user fees. Because the interests, needs, and grant support available to faculty researchers who use the Facility vary from year to year, its use as a source for half the Director's salary is problematic at best. More to the point, perhaps, the fees are needed in order to fund the continual re-supply of fresh cryogenics (liquid nitrogen and liquid helium) that are absolutely necessary for the operation of the superconducting magnets which are key parts of the Facility's three spectrometers.

6. Cost Effectiveness:

When funding for the Director's salary is settled with a more permanent and reliable solution than taking half the funds from the Facility's ORA, the measures of cost effectiveness will again be high. The Facility has been able to attain outside funds over the years in part because of the continued and reliable funding from the University itself. In other words, grants have been awarded because granting agencies such as the National Science Foundation (NSF) are not willing to support programs and facilities that do not receive reliable institutional support. Institutional support, then, when solid and unfailing, increases its own effectiveness.

This point is illustrated clearly enough in the case of the SIUC NMR Facility by the purchase in 2005 of the Facility's 400 MHz instrument through a grant from the NSF. Additional support from the NSF provided the NMR Facility with a high-resolution, solid-state upgrade to its 300

MHz instrument. In all probability, this support would not have come without the elemental financial backing of the University in the first place.

Most of the current Facility users described the fees charged as “fair” or “reasonable”. One faculty user suggested that the fees were approximately 30% higher than what would be charged at a comparable research university. The suggestion was made to restructure the fees policy so that long-term acquisitions (e.g., long-running biological and solid state NMR experiments) would be less costly per hour than short-term experiments. This would bring the fee structure more in line with national facilities.

7. Status of Available Equipment and Space:

There is some risk to the continued availability of the NMR instrumentation if the status of the ORA is not made secure and permanent. This is due to the fact that the regular re-supply of the cryogens is absolutely essential not only for the operation and use of the superconducting magnets in all the research projects that depend upon the use the Facility, but also for the bottom-line maintenance of the spectrometers. If, for some reason, an insufficient supply of cryogens were available, this would produce catastrophic failure (an event called a “quench”) that would require at least \$25,000 to bring the magnet back online. The threat of a possible quench ought to be undermined, and this will happen with a viable ORA.

Potential loss of needed cryogens is not the only problem or only need, to be sure. There is always the need for basic maintenance and repair of any physical instrumentation, and this is true with the NMR equipment. In recent years, necessary and routine repairs have been hampered by the loss of a graduate assistant, the loss of an electronics repair person, and the absence of the Director due to reasons of health.

Faculty responding to the survey feel the need for a high field instrument around 700-800 MHz. Recommendations were made for a new computer and work station dedicated to student use, and a spectrometer dedicated to teaching activities.

On our tour of the Facility we observed that Dr. Stevens maximizes the limited space available, but there seems to be very little space behind the instruments to complete regular maintenance and repairs.

Although the Facility was described by a user as “a little messy and cluttered,” most respondents report the room is well-maintained. On the other hand, space is getting tight, particularly with the acquisition of the new solids instrumentation, and here is no space for any additional equipment or future growth.

Faculty users were justifiably concerned that leakage from toilets above the NMR Facility and flooding caused by a faulty air conditioning system has caused—and may cause again in the future—significant damage to the equipment and facilities.

8. Suggested Means to Improve the Operation:

Not surprisingly, the simplest way to improve the operation of the NMR would be to remedy the unstable funding of the Director's salary, not only for his sake but also for the sake of making funds readily available for the maintenance and repair of the instrumentation, and to maximize the continued support for the Facility from outside sources such as the NSF. The most direct way to bring about this improvement is to fund the Director's salary directly from University resources, thus freeing the ORA monies to be used as they are intended. The University would also do well to fund a Graduate Assistant, and to make available reliable electronics repair and maintenance technicians.

Dr. Stevens needs regular assistance, at the very least, a part-time assistant to help with the cryogenic fills and setting up user accounts. The observed need for a graduate assistant assigned to the Facility on a regular basis was also shared by current NMR users.

Dr. Stevens lost his GA and that meant he had no relief from doing repairs and maintenance requiring repetitive motions. He does this in a space so cramped that his body is forced into stress positions. Over time that has injured him and his doctor says that recovery is only possible if he leaves the lab. But if he leaves the lab, there is no one to take over his duties and researchers suffer delays. Because he is dedicated, he cuts short his recovery and attends to the lab, which helps the researchers but exacerbates the medical condition created by having no one to relieve him, by him having to do repetitive motions in stress positions. If additional staff were not provided it doesn't matter who is Director: at some point in time, repetitive motion and stress positions may injure the Director, and cryogenic fills could be compromised.

The extended time that the instruments have been "off line" are a concern. Both the solids installation and Mercury 400 repair were delayed in part due to the difficulty experienced by Varian's installation engineers. The Inova 500 went down during Dr. Stevens health leave and there was no Facility staff to deal with that situation. The addition of staff would address some of these issues but not the apparent difficulty securing timely and responsive repair from the instrument manufacturers. According to Dr. Stevens, the more experienced and competent NMR engineers work through third-party companies such as Triangle Analytical and Open Technologies, although they have limited access to parts.

Dr. Stevens is able to make minor repairs to the equipment, but does not have background in electronics. Given the sophistication of the Facility instrumentation, personnel highly skilled in electronics should be available to assist with regular maintenance and repair of the NMR equipment.

DNA Sequencing and Allele Facility

The current DNA Sequencing and Allele Analysis Facility exists in order to facilitate research and education in the genomic sciences. It is a university-wide Facility managed by Dr. David Lightfoot. The stated purpose of this Facility is to assist students and faculty with the transition to high-throughput molecular genetic techniques made necessary by the genomics revolution, including DNA sequencing and robotics. It does so by providing access to genomic tools and services to students and researchers on the SIUC campus. It also encourages cooperative

endeavors with national and international public researchers, with private sector researchers, and with businesses and lawyers.

During our tour of the Facility we were struck by the pervasive collaborative research culture established by Dr. Lightfoot and the Facility staff and students. One female researcher, in “hijab” spoke of the family of researchers with whom she works using descriptors including “mutual respect” and “homeplace” for their work. The DNA Facility appears to be an exemplar of a diverse, collaborative, rigorous and supportive research environment for both students and faculty researchers. The students and technicians we spoke with were unanimous in their praise of Dr. Lightfoot’s guidance and commitment to their research and education.

1. Functions performed:

The Facility serves a variety of functions including DNA sequencing, genomics support (colony picking & arraying), grant proposal support, method development, and equipment loaning. Users of this Facility are diverse and come from the College of Agricultural Sciences (approx. 50%), the Medical School (10%), other colleges (30%) and off-campus users (10%).

According to the most recent Facility financial report, during 2006-2009 there were 4,929 DNA sequencing reactions attempted; DNA made from 100 human samples; 400 allele scores made; a BAC sub-library was built; four cDNA libraries were arrayed; PFGE service was provided; PCR screening was engaged in; 49 sequences were annotated; the Promega/Fisher supply cabinet was initiated; the VWR cabinet was negotiated; the Genewiz drop-box program for DNA sequencing was initiated; and the human genetics allele scoring Facility was opened .

Tours of the Facility are regularly provided for potential faculty hires, and the services highlighted that may assist faculty, both within and outside the typical user departments, in their research endeavors. For example, an allele assay has been developed to assist a new hire (Dr. May) from the college of Education and a gel assay was developed to help an Assistant Professor (Dr. Hernandez).

While the primary focus of the Facility is research support, it also serves the teaching mission of the university. Three 400 level courses used the Facility to demonstrate techniques. Classes that use the Facility include PSAS/PLB/ANSFN 433 Intro to Biotech; PSAS 426 Genomics; PSAS/PLB 571 Eukaryotic Genomics; PLB PSAS 427 Plant Biochemistry and CHEM 489 Forensics. Students are trained in the use of equipment appropriate for their individual projects. Access and training on state of the art equipment is an important educational component for our students, and is critical to their development as future world-class researchers and scholars.

The Facility has also served to enhance recruitment efforts of new students. For example, tours were provided to two high-school honors classes (Chemistry and Biology), and from those classes 5 students enrolled at SIUC. The Facility hosted interns from the MedPrep Head Start program (Macky Falker, Monica Bhattacharya), and two international visiting scholar from India (Dr. Navinder Saini, 1 year; Dr. Hemalata Sharma, 1 year); another from Egypt (Dr. Hany El Shemy, 6 months); and one from Pakistan (Mr. Hidayat Ullah, 6 months).

2. Effectiveness:

During the FY 2006-2009 years, there were 2,113 GenBank submissions (some are pending release on publication). From these, recognition was given to the Facility in 28 journal articles and more than 5 grant proposals per year that we know of, but not all users acknowledged the sequences generated by the Facility. Not all users have reported as yet, because sequences are released a year or two after generation. Therefore, some outcomes cannot presently be identified and the impact is likely larger than can presently be reported.

The Facility has helped SIUC garner federal funding, as, for example, for the proteomics Facility (NSF grant #DBI-0405819). Proposal preparation has been engaged in for 5 new projects. An updated Facilities Statement has been released to faculty. Listing the Facility helped two groups receive federal grants last year. A user group has prepared a pending request for genomic equipment that would be unlikely to be funded without the manager and operators expertise.

3. Need for Services:

SIUC is a Ph.D.-granting university that is constantly striving to improve its reputation as a cutting-edge research institution. As mentioned above, the very existence of the DNA Sequencing and Allele Facility was made necessary by the genomics revolution which drives a considerable amount of scientific research. The research derived from this revolution is important because it attempts to find ways to enhance the human condition while at the same time protecting the natural environment. If the University is to continue in its efforts to promote its research productivity and capability – and thus its reputation – then there thus is a clear need for the continuation and enhancement of the services provided by the DNA Sequencing Facility.

On a much more immediate scale, most users need assistance for new directions in their research, and the Facility provides this assistance.

4. User Satisfaction:

Only eight people responded to the user survey, and of those eight three mentioned that they had used the Facility in the past for specific sequencing projects, but no longer do so. Two of them said they stopped using the SIUC Facility because they have access to outside facilities (one at Iowa State, one at U of I) that are reliable and cheaper, and the third described concerns about reliability and accuracy at the SIUC Facility in prior years. While this particular researcher said he understood that changes had been made in subsequent years, he continues to use outside facilities anyway. When asked what they would do if the SIUC Facility were not available, the five respondents who do use the lab said they would probably use facilities at Vanderbilt or at the University of Illinois.

The one grad student who responded to the survey was the most effusive in voicing appreciation for the Facility. She said she uses it daily, would not be here without it, and praised Director Lightfoot and his staff for their work and helpfulness. The one post-doc fellow mentioned that he had utilized the Facility just one time, had not visited the Facility in person, and had no further comments.

In regard to the three faculty researchers who did respond to the survey, one said he uses the Facility regularly, one said he uses it occasionally, and the third used the word “sporadically” to define his own use pattern. Strengths mentioned included the approachability of the Director, helpful staff, fast turn-around time, and opportunity for grad students to learn to use the equipment.

In spite of the fact that there is a premium for use of the facilities by those outside the SIUC community, we may project a certain level of user satisfaction from outsiders. This conclusion is based on the fact that the Facility’s services have been used by researchers from Harvard, Yale, Oxford University in the U.K., Kansas State University, and even one fellow from Buenos Aires, Argentina.

Specific needs for improvement mentioned included improvements to the building (especially a new roof), expansion, update, and more funding for grad students.

5. Administrative Costs:

The center has been supported by the Vice Chancellor for Research’s (OVCR) office, the College of Agricultural Science (COAS), user fees, gifts and grants. Equipment use rates for SIUC researchers are charged at cost; outside users pay a higher cost for sequencing services.

Expenses for the Facility fall into three main categories: salaries, contractual/travel, and supplies. Salaries are the dominant expense. Approximately 70% of the remaining Facility expenditures are for chemical and for contractual costs including repairs.

One Graduate Student stipend has been provided per year. This level of support has been reduced to 0.125 this year because of COAS lacking funds to support the Facility.

6. Cost Effectiveness:

Compared to national averages and peer institutions, the Facility at SIUC appears to be quite cost effective. It has also shown flexibility in its mission which has enhanced its cost effectiveness even further. For example, the activities of the Facility are moving away from DNA sequencing and toward a more diverse service center as the needs of the campus research community have changed. As a result, the Facility produces over 60% of its costs from revenue, which is considerably higher than that reported by the Directors of both the Texas A&M and UIUC DNA sequencing facilities. In terms of the returns gained from SIUC’s own administrative support, it is reported that Mr. Yuan, Mr. Aziz, and Mr. Afzal (who graduated with his Ph.D. in the fall of

2007) are all gifted teachers of technique who are important to the research faculty, and to the overall efforts of achieving the “Southern at 150” goals for growth.

7. Status of Available Equipment and Space:

There is always a need for new equipment, and for the modernization and maintenance of existing equipment. The Facility has six broad categories of instruments available to students, several ABI 377 and ABI 3700 DNA sequencers, a CEQ 2000 fragment analyzer, a Circular Dichroism Spectrometer, several low volume PCR thermal cyclers, a Biomek 2000 liquid handling robot, an ABI 6700 DNA preparation robot, a GS2 picking and arraying robot, and a fluorescent slide scanner. For FY 2009, the Facility requested contractual funds to get a service contract for one of the ABI3700 (\$7,500) and/or to maintain one of the ABI377 sequencers (\$2,000) if funds be available. Each machine has different capabilities important to research. The ABI is very high throughput running 96 samples every 2 hours. The ABI 377 gives very high quality sequences in the first 30 bp after the priming site, important when checking ligation sites of new constructs. The Facility also requested contractual funds to maintain or repair the liquid handling robot (\$1,000), and \$1,000 for supplies for extension of the student centered capabilities of the Facility allowing maintenance of the chemical stock in order to provide users same-day sequencing services at competitive costs.

Outside concerns for the equipment itself, it is apparent that space in the Facility is adequate to its functioning, but it would be enhanced by improvements such as duct work for the fume hood. Mention was made by a couple of respondents about the condition of the roof on the building where the Facility is housed. Evidently temporary repairs were recently made. Other remarks parallel comments about the need for repairs and maintenance on many of the buildings on the SIUC campus.

8. Suggested Means to Improve the Operation:

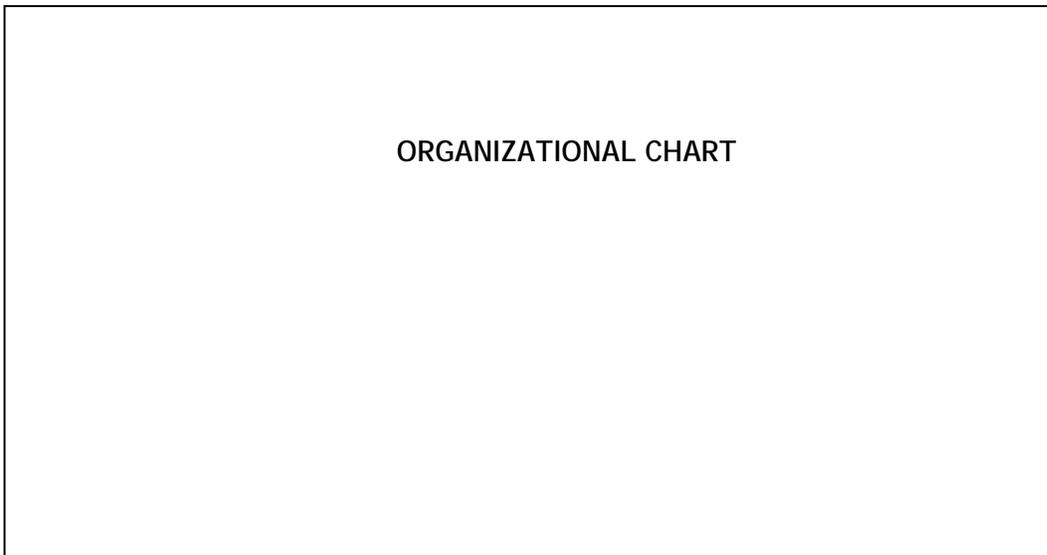
There is need for a reliable and stable level of financial support for students through the funding of at least one GA position, and for monies that can be used for minor repairs to the equipment that become necessary from time to time. For one thing, the stability of this support would eliminate the need to adjust rates on short notices. More basically, there is need for a level of commitment from the administration that would insure that the Facility does not fall behind in the acquisition of new equipment that reflects technological advances, especially in the area of nanotechnologies. A comparable commitment to prevent the Facility from being forced to use obsolete equipment is also required for its continued viability.

Due to the changing nature of technologies and required functions in this area of science, more frequent and regular external review of the Facility would allow a systematic mechanism to document the productivity of the lab, to provide persuasive data to make the case for resources, and to help identify potential funding agencies.

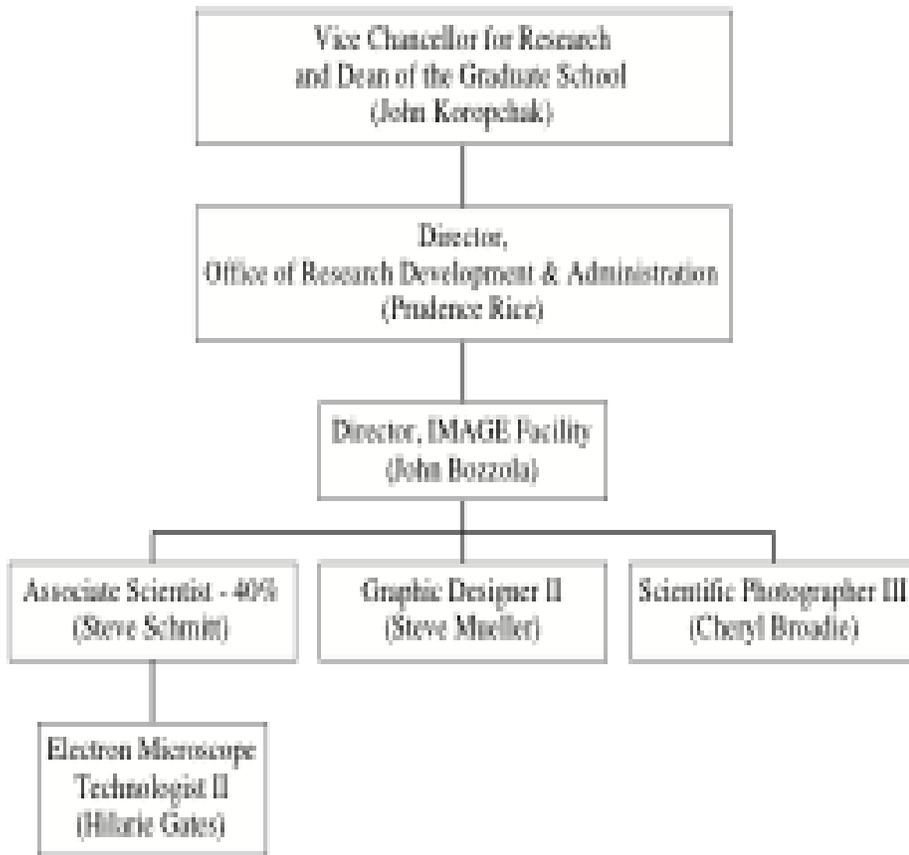
Part 3 Appendices

Appendix A: INTEGRATED MICROSCOPY AND GRAPHICS EXPERTISE FACILITY (IMAGE)

ORGANIZATIONAL CHART & MISSION STATEMENT



ORGANIZATIONAL CHART



MISSION & GOALS STATEMENT

Background and Mission Statement

The Integrated Microscopy and Graphics Expertise Facility (IMAGE) is one of the support facilities within the Office of Research Development and Administration (ORDA) of the Graduate School. The facility provides *service and training* in advanced microscopy techniques (light, electron, and atomic force) as well as service in the *production of graphics* (illustration and photography). In the area of microscopy, training is accomplished via *graduate level courses* as well as individualized training in the use of all instrumentation in the facility. Trained staff will prepare specimens, assist in the viewing of samples, assist in the writing of technical or budgetary proposals, as well as reports for granting agencies.

In microscopy, we currently have a full-time staff of three professionals (John Bozzola, Director, with a Ph.D. and 32 years experience in advanced microscopy, Steven Schmitt, Ph.D. with 19 years experience in microscopy and Hilary Gates, M.S with 17 years experience in microscopy). The microscopy facility merged with Research Photography and Illustration in 2000, hence the name, I.M.A.G.E. The Photo/Illustration unit consists of two professionals, an illustrator (Steven Mueller) and a photographer (Cheryl Broadie), involved in production of graphics for presentation (slides, posters) or publication (granting agencies, scientific journals, textbooks, theses and dissertations).

IMAGE is available for grant and contract work on a fee-for-service basis. The internal rates are designed to recover such operational costs as expendable supplies, service contracts on major instrumentation, telephone, postage, repair and replacement of small equipment. SIU covers most of the salaries in IMAGE (with the exception of 10% of the Associate Scientist position and part of the Director's salary). Outside rates are designed to recover all operating expenses as well as overhead of 200%. Income from outside sources is used to subsidize internal rates, making the use of IMAGE quite reasonable for faculty and graduate students, who sometimes pay for training using personal funds.

The facility has users in various disciplines within the university (Anatomy, Anthropology, Architecture and Interior Design, Biochemistry, Center for Advanced Friction Studies, Chemistry, Geology, Mechanical Engineering, Mining Engineering, Electrical Engineering, Physiology, Plant Biology, Psychology, Rehabilitation Institute, Plant and Soil Sciences, and Zoology). The facility has provided outside service work to other universities (University of Illinois, Howard Hughes Medical School, Washington University Medical School, SIU Edwardsville) as well as corporations worldwide (Ameren-CIPS, Monsanto, Rohm & Haas, Degussa Corp, Smith Kline Corp, Luminex Corp., Interfacial Dynamics, North American Lighting, US Forest Service, Polymer Laboratories Ltd., Johnson & Johnson, Uni Corporation, Westvaco, Sigma Chemical Company). As part of the service mission, IMAGE offers guided tours to the university and community (high schools, junior colleges) and sponsors workshops on modern research methods in microscopy and imaging, including the production of large-format posters for professional meetings.

Major equipment consists of a state-of-the-art analytical system composed of a Hitachi H7650 transmission electron microscope (acquired in 2005 via a \$600,000 NSF grant), Hitachi 7100 scanning transmission electron microscope (STEM) equipped for x-ray analysis (NORAN Voyager III) and digital, high resolution imaging at 125 kV. The TEM is connected to a variable pressure scanning electron microscope (SEM) also with x-ray analysis capability. This permits researchers to observe non-conductive specimens under more natural conditions than the conventional SEM and TEM. The EM system is networked with various light microscopes and macroscopes capable of capturing low light level images for further analysis. Other acquisitions (via a grant from the State of Illinois) include two atomic force microscopes and one scanning probe instrument. Preparatory equipment includes: ultramicrotomes (two new, Leica instruments acquired through a NSF grant in 2005), vacuum evaporators, critical point and freeze dryers, sputter coater, specimen trimmers, darkroom set-ups, copy stands, and miscellaneous small lab equipment.

Goals

The goals of IMAGE reflect those of the university: research, teaching, service.

- **Research** is supported by providing access to high technology imaging equipment (electron and atomic force microscopes, light microscopes and ancillary equipment) as well as providing services in photography (studio and field) and graphics (illustration).
- **Teaching** and training is accomplished by means of graduate level courses (SCI-501A,B Transmission Electron Microscopy, SCI-502A,B Scanning Electron Microscopy) as well as individualized training on specific equipment and techniques.
- **Service** is provided to on-campus users as described in Research, above, as well as to the local community by providing tours for local schools (colleges, high school, junior colleges, grades schools, science clubs and visiting scholars).

A Self Study of The IMAGE Center at SIUC

PROBLEM AREAS:

1. Budget & Staffing Issues. As with most units on campus, we are facing budget issues. For many years, our budget has consisted of salaries only (with 10% of the Director's and 10% of the Associate Scientist's salary being generated by user fees). All of our operating expenses, including service contracts (\$22,000), telephone service, supplies, equipment repair and replacement are covered by generated user fees (both internal and external).

In January 2009, we were told to expect a 10% budget cut, equivalent to \$25,537. Coincidentally, our Associate Scientist decided to take early retirement, so the shortfall would be covered by half of his salary line. Effectively, we lost half a position. Although we intend to rehire the Associate Scientist at a 50% level, we cannot expect him to work at full capacity.

Staff Reduction (A Critical Concern): Presently, the microscopy staff consists of two individuals, a Director and an EM Technologist II who are involved in: teaching graduate level lectures and laboratory sessions, assisting researchers to prepare and view specimens in any or all of the microscopes in the facility, routine maintenance of all equipment (electron microscopes, water chillers, computers, printers, small laboratory equipment), secretarial and book keeping activities, including billing, assistance with production and printing of large-format posters, writing of manuscripts/chapters/books, serving on graduate committees and even cleaning of the facility. It is **not** possible to run the microscopy unit with two people: a minimum of 2.5 positions is needed, with 3 being the ideal number.

One of our staff members, Hilarie Gates, has not received an appropriate salary increase in years. This continues, despite the fact that she has acquired skills far exceeding those required for her present position. For example, she is presently the only service individual on the SIU campus available to help researchers examine specimens in the Atomic Force Microscope. Most advanced imaging centers have a professional who specializes in this technology only.

Proposed Solutions: (1) 2.5 positions are needed, at the minimum, to run the microscopy unit. Otherwise, we will cut back on types of services offered (minimize teaching, since it is time intensive and not lucrative), minimize involvement with student committees, trim instrument availability by half (meaning, two electron microscopes instead of 4), raise user fees somewhat, pursue outside contracts. (2) Re-evaluate Hilarie Gates and adjust her compensation commensurate with her additional skills and responsibilities.

2. Equipment Upgrades. Due to the costly nature of our equipment, we do not expect SIU to purchase new or replacement equipment. Three years ago, John Bozzola was principal investigator (along with Co-PI's Karen Renzaglia and Peter Filip) on a successful NSF proposal to replace an aging transmission electron microscope. The instrument cost approximately \$600,000. Even though NSF did not require matching funds, the VCR-GD provided over \$30,000 to purchase some ancillary equipment.

We are more than willing to repeat this process to replace a 25 year-old scanning electron microscope that is facing the end of its useful life. This SEM is the most intensively used instrument in the facility and is heavily relied upon by researchers in many disciplines. A replacement, field-emission instrument is in the neighborhood of \$600,000. We have assembled a team to write the proposal but are facing a major obstacle: the university must provide 30% matching funds. When we asked for matching funds, we were told to go to the departments to see what they would be willing to contribute. I believe the reader knows the answer: very little money is available at the departmental level. Consequently, it is pointless to write a grant proposal.

Proposed Solution: SIU has a pool of money available to provide matching funds for high-end, shared instrumentation.

3. Computer Support Specialist. A critical function of our facility is to provide a means to send high-resolution (large file size) images to users. Presently, we are using a 7-year old computer running obsolescent file server software. Although the VCRGD kindly provided funds to upgrade the server (and other aging computers), we have been unable to make the new system functional. We are microscopists, not IT specialists, and since our attempts to find assistance has not been successful, our server is being used to produce graphics (posters).

We had also hoped that the server would host our facility website, but someone needs to design the site and instruct us how to upgrade and make modifications as needed. The website would serve a vital function of broadcasting the capabilities of the IMAGE Center that are available to students, faculty and even the industrial sector. Increasing the awareness of the IMAGE Center would certainly attract potential students as well as external, paying customers.

ORDA has provided some help. Marilyn Davis developed a basic IMAGE website and Ray Mestel helped troubleshoot problems with our PC's. However, we need a much more refined, local site that we can upgrade as needed and we need to know how to make our file server functional and manageable on a day-to-day basis. Once trained, we would maintain the server and website.

Proposed Solution: SIU provides the startup services of a specialist to put our file and web server online.

Appendix B: SIUC NMR Users Group Report (2nd Draft)
Inaugural Meeting, July 2006

Daniel Dyer, *Department of Chemistry and Biochemistry*

Yong Gao, *Department of Chemistry and Biochemistry*

Boyd Goodson, *Department of Chemistry and Biochemistry*

Yuqing Hou, *Meyers Institute*

Brian Lee, *Department of Chemistry and Biochemistry*

Gabriela Pérez-Alvarado, *Dept of Chemistry and Biochemistry*

William Stevens, Director, *SIUC NMR Facility*

Introduction. On July 18, the above NMR users met with the Director of the SIUC NMR Facility to form an NMR Users Group concerned with maintaining and enhancing the capabilities of the NMR Facility. During this inaugural meeting, the Group identified an urgent issue relating to Facility personnel support.

The purpose of this Report is to summarize the Group consensus reached at the meeting, and to provide background information that we hope will be useful in framing future discussions. It is our hope that this Report will help establish a cordial and constructive dialogue that will ultimately contribute to finding a long-term solution to the identified problem.

At the outset, it is important to point out that the NMR Facility has benefited from considerable material, personnel, and infrastructure support from the SIUC research administration over the years. Indeed, this support has played crucial roles in the successes of a wide range of research endeavors, as well as the development of the NMR Facility over its history. As this Report details below, we believe that such support must be maintained if the current successes and growth of SIUC's chemical/biochemical/materials research enterprise are to continue.

Background. SIUC has a strong research tradition involving Nuclear Magnetic Resonance (NMR) spectroscopy; indeed, NMR has been performed on this campus for decades in support of a wide variety of research efforts. The SIUC NMR Facility was founded in 1987 as a University-wide resource. For most of the Facility's history, it was sponsored by the Graduate School, the School of Medicine, and the College of Science; those three agencies shared equally the repair costs, travel expenses, and other financial needs of the Facility—except for the salary line of the Director's position, which (until very recently) was paid half by the Graduate School and half by the School of Medicine.

Once consisting of older (VXR Varian) 300 MHz and 500 MHz instruments, the Facility now oversees operation of three modern Varian NMR spectrometers operating at 300, 400, and 500 MHz, respectively obtained in 2004, 2005, and 2000. While the majority of the Facility's instrumentation was purchased via on-campus resources, the 400 MHz instrument was recently purchased with an external grant awarded by the NSF. A high-resolution solid-state NMR upgrade to the 300 MHz instrument was also recently awarded by the NSF in a separate grant. **Importantly, support from SIUC for the NMR Facility was outlined in these (and other) proposals, and was undoubtedly a critical component to SIUC's awarding of these (and other) grants.**

The instrumentation and software of the NMR Facility are routinely used in support of various chemical, materials, and biochemical experiments, and thus **the availability of this infrastructure is critical to the research capability of various groups—and consequently, the University's research enterprise as a whole.** In addition to the faculty listed above, the NMR Facility is routinely used by numerous graduate students, undergraduate researchers, and post-docs.

The NMR Facility also plays an important educational role. For example, use of the NMR facility has been integrated in the undergraduate chemistry curriculum (e.g., CHM 466b), and NMR is an important part of several undergraduate and graduate courses. Moreover, because of the ubiquity of NMR in industrial, academic, and government research sectors, training in the use of modern NMR principles and methods provides a crucial skill set for our undergraduate chemistry majors and graduate students alike. Indeed, the most recent guidelines for the American Chemical Society state that certification and maintenance of an excellent undergraduate program “...*should incorporate into the curriculum several pieces of sophisticated equipment suitable for undergraduate instruction and research. One of these must be an NMR spectrometer...*”.

In short—**without a well-maintained NMR Facility, research in many groups would slow to a crawl; in addition, we would lose our ACS accreditation for the undergraduate chemistry degree; moreover, the lack of such a Facility would hamper SIUC's ability to recruit new faculty (and students) as well as to maintain current hires.** [*Ed. Note: a detailed description of the many uses of NMR in various research efforts on campus is not provided here in the interest of brevity; however, such information can be readily provided by the Users Group upon request.*]

Recently, the School of Medicine ended its commitment to NMR research after the departure of Dr. Jianjun Wang, and has since discontinued its salary support for the NMR Director position. Presumably as a stop-gap measure, this half of the Director position's salary line has recently been moved to the NMR Facility's Overhead Recovery Account (ORA).

These ORA Funds are generated exclusively through user fees, which by their nature are limited and highly variable over time. Moreover, up until very recently the ORA had been dedicated exclusively towards the purchase of needed cryogenics (along with charges associated with minor instrument repair). Thus, due to the variable nature of the ORA—as well as to the recurring nature of the unavoidable

expenses to which this account has traditionally been dedicated—**use of the ORA to support salary lines is untenable, even in the short term.**

Thus, the current support strategy for the NMR Facility is a concern of increasing urgency for the NMR Users Group.

ORA Status of the SIUC NMR Facility. As of July 29, the balance of the NMR Facility's ORA is **\$7,000**. At the current rate of depletion (resulting primarily from ORA funds being used to partially support the salary line of the Director position), the ORA is now projected to “zero-out” in less than two months' time.

It is instructive to briefly review the revenues and allocations of the ORA:

- Annual revenues to the ORA have varied widely (between **\$2,400/yr** and **\$25,550/yr** over its 19-year history), waxing and waning according to the interests, needs, and grant support of various faculty in different departments.
- Fees for “self-use” of the NMR instrumentation by trained SIUC researchers are applied hourly at \$8/hr, \$10/hr, and \$12/hr (cut in half during nights and weekends) for the 300 MHz, 400 MHz, and 500 MHz instruments, respectively, and are capped at \$20,000/yr per user, per instrument. Based on a (non-scientific) sampling of user fees via the World Wide Web, the current fees are already at the high end of user fees charged for internal users at academic NMR Facilities nationwide:

In no particular order:

- North Carolina State: 500 MHz, \$8.00/\$4.00/hr; 400/300 MHz, \$2.00/\$1.50/hr (peak/off-peak hrs)
- Ohio State: \$4.20/hr, all instruments, all times
- Arizona State: 500/400 MHz, \$2.50/hr; 300 MHz, \$2.00/hr
- UNC Chapel Hill (Pharm.): 500 MHz, \$8.00/hr (\$5/hr for long-time experiments); 300 MHz, \$5.00/hr (\$2.00/hr at night).
- Iowa: a complicated schedule that varies by time, day, and instrument, but basically comes to about \$2-\$7/hr plus one-time access fees of \$2-\$3 for all instruments
- **Iowa state***: \$5/hr for all instruments
- Florida State: \$1.50/hr for all instruments
- U. Maryland, BC: 500 MHz, \$15/hr; 400 MHz, \$10/hr
- **Ohio University***: zero fees
- **Colorado***: 500 MHz, \$6.57/hr
- Washington St.L.: variable from \$8/hr to \$20/hr for all instruments depending on monthly usage (i.e., significant discounts for purchasing NMR time in bulk)
- U. Maryland (Pharm.): 500 MHz, \$7.50/hr; 300 MHz, \$750/year
- SUNY Stony Brook: \$16.50/hr for all instruments
- Wisconsin: zero fees
- **LSU***: 500 MHz, \$30/hr; 400 MHz, \$20/\$25/hr; 300 MHz, \$10/hr
- **Texas Tech***: zero fees
- **Kentucky***: zero fees

(*Indicates current/aspiring peer universities listed in the Southern at 150 Plan; in-house NMR fees of the other peer institutions were not readily available online).

- In principle, the SIUC NMR Facility fees are much greater for for-profit (industrial) users; however, potential industrial users in this region are almost non-existent. Furthermore, private companies that are solely dedicated to providing NMR services have sprung up over the past decade; thus, it is unlikely that our facility will be able to compete for these customers.
- On average, annual outgoing allocations currently total *ca.* **\$13,000/yr** in commodities (primarily for cryogenes) and parts/contractual services (for minor repairs).

Cryogen costs are essentially fixed, and are not optional. Regular re-supply of fresh cryogenes [liquid nitrogen (N₂) and liquid helium (He)] is required for operation of the superconducting magnets used in the Facility’s three NMR spectrometers. The current vendors of SIUC’s cryogenes offer competitive pricing; nevertheless, the cryogen costs are fixed (and have risen by about 50% because of the addition of the third spectrometer in 2005), now totaling about **\$12,000/yr** (a good rule of thumb for per-system annual cryogen costs is ~\$4000/yr). Note that **lack of sufficient cryogenes for an NMR magnet will result in its catastrophic failure (“quench”)—an event that would require at least \$25,000 to bring the magnet back online**; naturally, this cost would be far greater if the magnet is permanently damaged by the quenching process.

Conservative use of the ORA by the current Director has allowed small excesses in user fees generated during “high use” years to “roll over” and compensate for insufficient funds generated during lean years—allowing the ORA to run in the black throughout the history of the NMR Facility. Nevertheless, it is projected that annual cryogen costs will exceed annual recovery of user fees in the short term (e.g., until new faculty obtain sufficient external funding to permit much greater utilization of the 500 MHz instrument). **Thus, it is recommended that an expense account be established to cover such expected short-falls in the near term to help meet the overhead expenses of the Facility.**

In any case, user fees would have to unrealistically (and reliably!) jump an *additional* ~\$30,000/yr in order to support 50% of the Director’s salary line on top of the fixed overhead costs associated with the day-to-day running of the NMR Facility. Not surprisingly, **payment of any portion of an NMR facility Director’s salary from user fees is not standard practice at most major public research universities**, as indicated below.

Support for NMR Facilities at other Public Research Universities.

It is relevant to compare the funding structure for SIUC’s NMR Facility with those of other public research universities. We have begun to solicit this information from the corresponding NMR facilities located at the Current and Aspiring Peer Institutions identified in the SIUC Southern at 150 Plan. As this process has only just begun, we have data only from four such institutions (described below); nevertheless, similar information has also been compiled recently by the Association of Managers of Magnetic Resonance Laboratories (AMMRL; see: **Error!**

NMR Facilities at U.S. Public Universities: Facility Managers/Directors, Source of Salary Funding
47 Universities Sampled

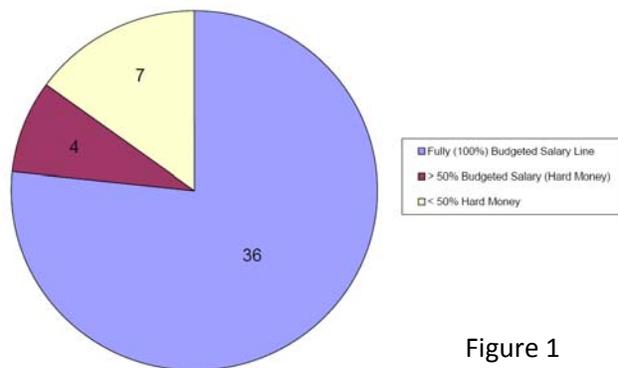


Figure 1

Hyperlink reference not valid.) The AMMRL survey compiled responses regarding support and salary lines from NMR Facilities within 47 public research universities in the United States.

Relevant data are summarized in Figures 1 and 2. Importantly, the AMMRL found that the vast majority of surveyed Universities (~77%) supported at least one full-time staff position (i.e., the Director) with a 100% hard-money salary line. Correspondingly, only a handful (~23%) put *any* user fees (overhead-recovery) to support the Director salary line (and only half of *those* use 50% or more for this purpose).

Similar results are reported by the four current / aspiring peer universities who have responded thus far to our queries:

- Oklahoma State: 2 full-time staff on 100% hard money; user fees used exclusively for overhead (i.e. cryogenics/repairs);
- LSU: 2 full-time staff on 100% hard money, plus a GA line, also on hard money. Again, no support from user fees for these positions;
- Texas Tech: 1 full-time staff and one GA line, both 100% hard money (Texas Tech does not charge fees from on-campus researchers for access to their NMR instrumentation).
- University of Kentucky: 2 full-time staff plus a GA on 100% hard money (like Texas Tech, fees are not charged to on-campus researchers for instrument time).

We are aware of only one U.S. public research university that can completely support its Director with user fees and chooses to do so: U.C. Berkeley—one of the largest and most resource-laden research universities in the world. Thus, in line with the original funding structure for the SIUC NMR Facility, staff positions associated with NMR facilities at other public research universities are generally funded with hard money.

Some Concluding Thoughts. While the narrow scope of this Report concerns only the funding structure of the SIUC NMR Facility, we realize that the same issues are also relevant to larger-scale discussions involving a range of in-house academic research facilities, at public and private research institutions across the country. For example, the temptation might exist to attempt the application of a business model to campus research facilities, whereby such entities would ultimately be expected to become self-sufficient, or even “funds-generating”. However, we see research facilities such as the NMR Facility as “opportunity-generating” entities, as their on-site presence permits research initiatives that would otherwise be difficult, impractical, or impossible in their absence. Thus, adequate support for such Facilities must be maintained if the research enterprise of the university is to continue to grow in accordance with the goals of Southern at 150.

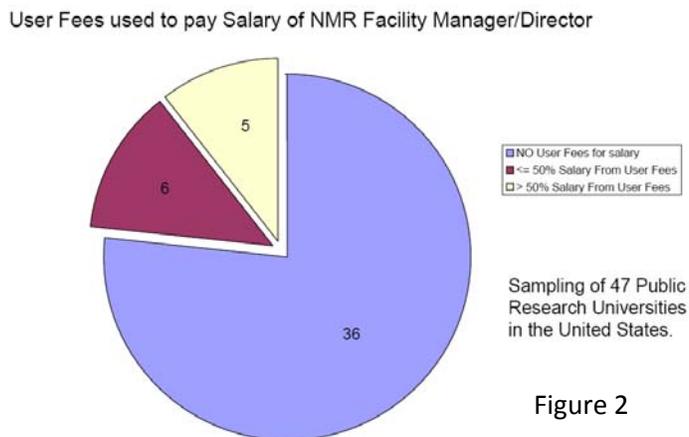


Figure 2

(continued...)

Consensus Summary.

- The NMR Facility has been an important component of SIUC's research enterprise for nearly 20 years;
- *Expanding* SIUC's research enterprise is a key component of Southern at 150;
- Ready access to an array of well-maintained NMR instrumentation has been—and continues to be—crucial for research efforts on campus;
- Well-maintained NMR facilities are crucial to the research enterprise of any serious research institution, and (to our knowledge) they are universally found at research-intensive public Universities—and are not a luxury;
- The NMR Facility plays vital roles in both 1) supporting current research-active faculty; and 2) recruiting new faculty;
- The NMR Facility plays an important role in the education and training of students on campus at both the undergraduate and graduate level;
- An NMR Facility must be adequately staffed to ensure proper instrument and software maintenance, sufficient user training, safety, and fair allocation of instrument time;
- The SIUC NMR Users Group believes that to be adequately staffed, the SIUC NMR Facility must have at least one full-time Director—in addition to a graduate assistant (and ideally, some wages to permit on-site electronics repair);
- The vast majority of public research universities fund (at least) one permanent salary line (e.g., the Director) on 100% hard money—with no portion coming from user fees / ORAs;
- Current use of the SIUC NMR Facility's ORA to fund part of the salary line for the Director's position is untenable—even in the short term—particularly in light of the fixed cryogen costs;
- Based on the above facts, **the SIUC NMR Users Group cordially requests the opportunity to discuss this problem with appropriate members of the Administration**, with the goal of obtaining a long-term solution to this problem.

Preliminary Recommendations.

- The salary line allocated to the Director's position should be funded 100% from hard money, with no portion coming from user fees/ORAs.
- A 50% graduate assistant (GA) line should be re-established for the NMR facility (to perform liquid N₂ fills, assist the director in liquid He fills, assist in user training, instrument maintenance, student oversight, etc.). Note that safety requires that two trained individuals are involved in all liquid He filling procedures.
- An expense account should be established to cover expected near-term short-falls in user fees to help meet the additional costs of cryogenics and occasional on-site maintenance by trained electronics-servicing personnel.

