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DATE: May 8, 2006

RE: Report of the External Review Team
M.S. Program in Chemistry, Western Carolina University

We apologize for the delay in sending this report to you. The report includes a discussion of our findings, followed by a bulleted list of what we perceive as strengths, weaknesses and opportunities of the program.

We conducted our visit to Western Carolina University on March 1-2, 2006. The visit began with a tour of the chemistry department (lead by Bill Kwochka) in the afternoon of the first day, followed by dinner with some faculty members of the Chemistry Department. The second day began with a breakfast meeting with two faculty members, followed by meetings with non-tenured faculty, Dean Robert Kehrberg, tenured faculty, graduate students, and Ms. Krista Schmidt (reference librarian). A meeting with Dean Scott Higgins concluded the visit.

The Chemistry Department possesses a cadre of dedicated, collegial, faculty members who are committed to delivering high quality education to graduate and undergraduate students through classroom teaching and research experiences. The faculty's commitment to education is reflected in the comments of the graduate students interviewed during the visit, and by those of three undergraduate alumni who recently obtained Master's degrees in Chemistry from a sister institution (UNC Charlotte). The quality of education provided by the faculty is also evidenced by the success of WCU Chemistry M.S. graduates in obtaining employment in industrial, academic, and government laboratories and gaining admission to advanced degree programs at prestigious universities.

The Chemistry Department offers a Master of Science (M.S.) degree, an M.S. degree with an environmental concentration, and a Four-Plus-One degree, all of which are research-based. In addition to the environmental focus, the Department recently added biotechnology and forensic chemistry as research themes. The success of WCU's Chemistry M.S. graduates in securing employment and gaining admission to doctoral programs is undoubtedly due in large part to the research component of these degree programs. A course-based Master's degree, although simpler and less expensive to administer, would make graduates of the program far less competitive; we therefore do not recommend following the course-only route for the M.S. or Four-Plus-One degrees.

The Department recently established a Master of Entrepreneurship (M.E.) in the sciences in collaboration with the College of Business. The Master of Arts in Teaching with a concentration in chemistry (M.A.T.) and Master of Arts in Education (M.A.Ed.) with a concentration in chemistry are offered in conjunction with the College of Education. It is our understanding that these degrees are not predominantly research-based, and that the lack of emphasis on research is appropriate for such programs.

Conducting research in the field of chemistry in an effective manner requires excellent student mentoring, good facilities and equipment, and adequate supplies. It is apparent that the chemistry faculty members at WCU serve as excellent mentors, but we are concerned about their ability to sustain the high teaching loads they carry while at the same time being productive in research.

Nearly all of the chemistry faculty members have 12 contact hour (4 course) loads per semester (exceptions are the department chair and some program directors, one of whom is a first year faculty member). This is an unusually high course load for any faculty member who is also expected to conduct research. In addition, it appears that having more than two *different* preps per semester is common at WCU. To our knowledge, most other chemistry departments that offer research-based Master's degrees provide at least one three-hour course reduction per semester for each faculty member who conducts research, and many institutions provide released time beyond that to new junior faculty members. At UNC Charlotte, a 12 contact hour course load is only assigned to tenured chemistry faculty members who are not involved in research at all, and it is highly unusual for those faculty members to have more than two different course preps per semester. At Marshall University, all faculty who supervise student research have their teaching loads reduced by 2-6 hours per semester and are limited to two course preps per semester. *The present situation is unsustainable: teaching loads of the research-active faculty members at WCU must be reduced.* Furthermore, efforts must be made to reduce the number of different preps per semester. The fact that four faculty members have voluntarily left WCU in the past five years provides strong evidence for the need to reduce teaching loads.

The situation of new faculty members is of grave concern. New faculty members do not have the time needed to begin their research programs during the first year, which puts their tenure and WCU's investment in them at risk. During the first 2-3 years, junior faculty members need to have lighter teaching loads than the other research-active faculty members, and the number of different preps expected of them needs to be kept to a minimum. The reduced number of contact hours and number of preps will allow the junior faculty to launch their research programs, train students to help them with research, and secure external funding needed to support students, purchase equipment and supplies, and provide summer stipends and travel funds. Reduced teaching loads will also provide junior faculty members with the time needed to learn how to become effective mentors to their students. The long-term success of the department and its programs depends on the development and success of its junior faculty members.

In general, the junior faculty members did not appear to have a clear sense of what is expected of them to achieve tenure and promotion. It is important for them to understand tenure

expectations at the department, college, and university levels so that they will know where to focus their efforts in order to obtain a successful tenure decision. The department should ensure that its written guidelines reflect what is expected of candidates for reappointment, promotion and tenure, and that opportunities are available for junior faculty members to discuss reappointment, promotion and tenure expectations at the department, college, and university levels.

The Department needs to find ways to free up faculty time for scholarly activity and mentoring students in research while meeting its teaching needs. The Department clearly needs to hire at least two additional faculty members. It should consider carefully the types of faculty members that would best suit its mission and needs. Some possible hires are discussed below:

- *One or more full-time lecturers.* Lecturers could carry 4-course semester loads and would free up tenure-track faculty time to do research.
- *A Senior Instrument Analyst/Lecturer.* This person would be responsible for upkeep of instruments, training students on how to use instruments, and assisting in research projects and laboratory courses (instrument upkeep and/or training). The person hired would not necessarily have to teach courses. Addition of a Senior Instrument Analyst would free up faculty time to do research by relieving the tenure track faculty members of the responsibility of instrument upkeep and training.
- *Tenure track faculty.* Hiring tenure track faculty is also desirable, but the Department should strive to recruit new faculty members who would bring research expertise in areas that would benefit the Department, and who would collaborate in research with faculty members of the Master's program and/or in other departments. The Department also needs to keep in mind the size of its graduate program when recruiting tenure-track faculty who will be expected to be research active: the number of graduate students available to do research and the number of tenure track faculty seeking graduate students to do research must be kept in balance.

Two issues of concern in the recruitment of new faculty members include the level of start-up funding and employment opportunities for partners/spouses. While the reviewers do not have national norms for start-up funds, they know of no program of comparable size and ambitions that has start-up funds totaling less than \$25,000. WCU should explore ways of reaching this target, or it will risk losing high quality candidates who opt for offers made by competing institutions. This could include spreading the start-up over two years (which is already being done). The package should be structured so that a high priced item could be paid for using money from both years.

The issue of partner/spouse employment in the recruitment of new faculty is of concern because of the remote location of WCU. The University will need to consider possibilities for assisting spouses/partners in finding employment either in the local community or on campus.

The students we interviewed spoke highly of the graduate program and the accessibility of the faculty. Particularly notable was their support of the extensive seminar program because students typically avoid public speaking situations whenever possible.

The ability to recruit high-quality students is a key factor to the success of any graduate program. The graduate student stipends currently being offered in the chemistry department are too low and must be raised to recruit good students to the program. The isolated location of WCU makes it difficult for students with spouses or significant others who plan to relocate to find employment. Left unchanged for a significant period of time, the low stipends will become a threat. It will also be important to obtain more out-of-state tuition waivers (understandably not an easy task), or to find other ways to fund out-of-state tuition so that the cost is not passed on to the students. An increase in the number of out-of-state waivers will allow the Department to recruit more students from nearby states.

We were pleased to see that nearly all major equipment in the department is less than 5 years old, and that all basic chemical instrumentation is available on site to students and faculty alike. The Department should continue to acquire instrumentation needed to support its research activities and attract new hires.

The library budget and availability of electronic materials (e.g. journals & SciFinder Scholar) are supportive of the graduate program.

Continued building renovation will be vital to the department and its programs. The building in which the chemistry department is housed lacks sufficient hood space for teaching and research purposes. The building itself does not aid in the recruitment of faculty or students, particularly since other campuses within the UNC system (East Carolina University, UNC Wilmington, UNC Greensboro, and Appalachian State University) have new or relatively new buildings that house their chemistry departments. We were pleased to see that some building renovation was in progress.

The Chemistry Department's faculty members have funding available for presenting their work at professional meetings. This is a great asset for professional development and networking, securing external funding, and establishing collaborative research projects.

At present, no F&A recovery funds are distributed to either the college or departments. A mechanism should be developed whereby at least some of these monies are distributed on a formulaic basis to departments so that they can use it to support research. Such funds can allow departments to help faculty between grants, faculty who are moving into new research areas, to upgrade equipment or pay for repair costs, or for other ways to support research.

The Biotechnology focus should allow for partnerships with businesses interested in exploiting the local ecology (Biotechnology and Environmental Chemistry). Possibilities also exist for partnerships within the university (e.g. the Department of Biology). The idea of concentrating biotechnology on local flora is a good one.

The department currently has 3 "themes" for its research activities (environment, biotechnology, and now forensics) in addition to other research areas (i.e., organic synthesis). We advise the department to be careful about adding too many areas of focus, given the relatively small size of the faculty.

We summarize below our findings as a bulleted list of strengths, weaknesses, and opportunities.

Strengths

- *Dedicated, collegial faculty members.* WCU faculty members are committed to delivering high quality education to graduate and undergraduate students through classroom teaching, research experiences, and one-on-one mentoring. We rate the commitment of the faculty to student education and professional development as the program's greatest asset.
- *Successful graduates.* Master's graduates are successful in obtaining employment in industrial, government, and academic laboratory settings and are admitted to high-quality graduate and professional programs. The students spoke highly of the program.
- *New research equipment.* Many of the major pieces of equipment in the department are less than five years old. The department needs to continue this trend and, if it has not already done so, develop a plan for acquiring new equipment and replacing old equipment. This equipment also strengthens undergraduate teaching and research.
- *Environmental focus.* An emphasis on the Southern Appalachian region takes advantage of WCU's location.
- *The library.* The budget and availability of electronic materials (e.g. journals & SciFinder Scholar) are supportive of the graduate program.

Weaknesses

- *High teaching loads.* Teaching loads are too high for the faculty to sustain productive research programs. Faculty need more time to devote to mentoring students in research, writing publications, and securing external funding needed for research while still delivering high-quality education in the classroom.
- *Delayed establishment of research programs.* The junior faculty members are not getting their research programs up and running during their first year at WCU. They must be provided with the time needed (i.e., reduced course loads and minimum number of preps) to launch their research programs as early as possible. Early establishment of their research programs will better position the junior faculty members to recruit students, receive external funding, and obtain the results needed to submit papers for publication in peer-reviewed journals.
- *Unclear tenure expectations.* The junior faculty members do not have a clear idea of what is expected of them for a positive tenure and promotion decision. We feel that the responsibility of communicating these expectations lies at the departmental, college and university levels.

- *Very low graduate assistant stipends.* This probably causes WCU to lose good candidates who elect to go to other institutions that offer higher stipends. WCU should work to find ways to offer stipends that are competitive with those of other peer institutions and public institutions in the surrounding area (North Carolina, South Carolina, Georgia, Tennessee, Virginia).
- *Instrument maintenance and student training expectations.* The burden of maintaining instruments and training students to use them lies with the faculty. The department should consider hiring a Senior Instrument Analyst (lecturer) to assist them with these time-consuming (but necessary) tasks.
- *Poor start-up funding.* The amount of start-up funding (\$8K per year for two years) for new faculty members is too low and puts WCU at risk for losing excellent candidates to other institutions. We are unaware of any other Master's program that offers less than \$25 K for startup. Many Master's programs in Chemistry offer start-up packages at least in the \$40-\$50K range.
- *Family considerations.* The remote location of WCU can make it difficult to hire faculty who have spouses/partners who also seek employment. WCU should consider creative ways to help spouses/partners find positions in order to help to attract top candidates.
- *Lack of hood space.* There is currently not enough hood space to accommodate the teaching and research needs of the department.

Opportunities

- *University location.* WCU's position as the only institution west of Charlotte to offer graduate programs in chemistry can be used as an asset, particularly for students who would like to remain near home.
- *Community and business outreach.* The Biotechnology focus should allow for partnerships with businesses interested in exploiting the local ecology (Biotechnology and Environmental Chemistry). Possibilities also exist for partnerships within the university (e.g., the Department of Biology).
- *Graduate program expansion.* Members of the Department expressed interest in increasing the size of their graduate program if funding (internal and/or external) becomes available. Increasing the number of graduate students could lead to an increase in research productivity, which could result in an increase in the number of grants and publications.