

Report of the 2013 Academic Program Review (APR) External Committee on the Department of Chemistry and Chemical Biology, University of New Mexico

Members of the APR External Committee:

Anne B. McCoy (The Ohio State University)

Peter M.A. Sherwood (University of Washington, Kansas State University, Oklahoma State University)

Bernd Bassalleck (UNM, Department of Physics & Astronomy)

The Committee received a charge from the Associate Provost for Curriculum, Gregory Heileman, dated April 9, 2013. Prior to the two and a half day site visit (April 22-24, 2013) the Department provided copies of an extensive Self Study. Several other documents were provided during the site visit. The Committee basically followed the schedule prepared by the UNM administrators, meeting with a large number of department constituents as well as various members of the UNM upper administration. In the latter case, there were some difficulties lining up people. For instance, we were disappointed that we were never able to meet with the Dean of Graduate Studies, nor to meet with the Vice President for Research.

The Department of Chemistry provides a full range of teaching at the undergraduate (BA and BS) and graduate level (MS and Ph.D). A diverse research program is being conducted compatible with a major research university. In our report we discuss the contributions made by the department to the teaching, research and service activities of the university, and we make recommendations which we believe will position the department to play its full role in the university as a central science department and to grow its national and international contributions to the chemical sciences.

In order to meet its full potential the chemistry department and the university need to address some significant issues which we believe will pave the way for an outstanding department which will meet the needs of the state and the nation. The addressing of these issues will need the full involvement of the department, the dean and the central administration. In particular the Provost, the Vice President for Research and the Dean of Graduate Studies will be key central administration participants. The central nature of the chemical sciences means that an outstanding chemistry department plays a key role in an outstanding university. As one university president noted - "one can tell the quality of a university by the quality of its chemistry department".

Overview

The department is engaged in teaching, research and service.

Teaching

We note that the department has a full range of teaching conducted by all faculty. Many of the undergraduate courses are taught by a dedicated team of instructors who are solely engaged in

teaching at the undergraduate level. A concern is expressed below that tenure/tenure track faculty be more involved in teaching these courses than they currently are. This is being delegated too much to lecturers, their obvious talents and dedication to teaching notwithstanding.

The department teaches a large number of students in the first two years relative to the number of majors. The department should institute a smaller section of introductory chemistry for chemistry, biochemistry and chemical engineering majors. This will benefit the other programs as well as increase the number of majors.

There are a range of graduate courses, though we found that some graduate students found that there were challenges in getting the courses they needed. There may be merit in balancing the need for minimum course numbers with the importance in offering suitable courses to ensure that graduate students complete their necessary course work in a timely manner. A chronic problem with offering graduate elective courses is that they're often officially under-enrolled, and yet the students clearly need them. A creative solution to this issue needs to be found at the College level.

There was real concern about the way in which teaching assistants were trained. While we commend the department for developing and implementing a training course, we share the concerns of many faculty as to whether teaching assistants need to be required to take this class each semester she or he is employed as a TA. Rather, the department may want to require enrollment in the class either the first semester or first year of a teaching appointment.

The BA/MD is well coordinated with the biology department. Biology seems satisfied with the chemistry part of this program. Chemistry is interacting well with engineering departments, particularly chemical engineering.

Assessments of the teaching programs are being conducted and the department seems committed to the assessment program. At some point we were told by a member of the upper administration that assessment reports had not been done. Upon further inquiry, we were given the impression that this particular problem rested in the College, and not in the department.

We do consider that the department is doing an excellent job in their offerings for the core program.

Research

The department has extramural funding that has varied around \$2.5 million per annum for the past seven years (slightly less in 2012 - \$2,282,845). This places it behind three other departments in the College of Arts and Sciences, namely Biology (\$12,732,404 in 2012), Physics and Astronomy (\$7,583,882 in 2012) and Earth and Planetary Sciences (\$2,864,011 in 2012). This level of funding puts the department in the range of the fourth quartile of chemistry departments, though comparisons are complicated by the structure of chemistry departments nationally (which may or may not include biochemistry which generally attracts substantial NIH funding) as well as differences in the faculty size of departments. We do note that the current extramural funding is mainly received by a limited number of faculty. ***The loss of key faculty (to***

retirement or moves to other institutions) could substantially impact the level of external support.

We are concerned that the number of graduate students are falling (in contrast to the increase in undergraduate numbers). A department of 20 faculty who are directing graduate students should have a significantly larger number of graduate students than are currently enrolled (there were 45 graduate students enrolled in 2011).

We discuss below how the research activities of the department are impacted by cultural issues, by space and facility issues, and by issues related to retention and faculty size and morale.

Service

Faculty in the department are contributing to service in the university, the community and in their discipline. We do note the concern that the fraction of the faculty involved in administrative roles is detrimental to the department's research activities and the overall performance of the department.

Principal Observations

Our **major observations** can be summarized in the following three points:

- 1) There is a *serious culture problem* in the chemistry department.
- 2) *The size of the faculty is too small.*
- 3) *Inadequate infrastructure, resources and space*, affecting both of the above issues.

These three major observations will now be addressed in more detail, including our recommendations.

1) The very serious culture problem in the department was made blatantly clear to us both early on, i.e. already expressed in the Self Study document by the Chair, and often in our conversations with many faculty and the Chair. This inter-personal problem is clearly a long-standing problem. It is one that we believe can be turned around and really must be turned around or the department appears doomed. It appeared to us that this problem cannot be traced solely to some individual faculty members. In fact the culture issues appear to predate the hiring of some of the most polarizing faculty. Until it is turned around, retention of faculty will continue to be a problem.

In response to this several members of the faculty have elected to pursue administrative positions or leadership in multi-disciplinary programs rather than remaining engaged in departmental activities. Others have sought positions elsewhere, and the rate of loss of research active tenured faculty to other institutions has been unacceptably high. Both of these symptoms of the culture problems have the effect of making it even more challenging for a small faculty to work effectively.

Coupled to these problems are the development of factions within the department and a feeling of disenfranchisement that was expressed by a number of the faculty, and the lack of continuity in leadership (the department has been led by four different individuals over the past six years). The establishment of an advisory committee of senior faculty should help in the feeling of involvement in important decision making processes among the faculty. In addition we strongly encourage the Provost and Dean and other members of the upper administration to meet with the faculty, as offered by the Provost in the exit meeting.

The problem should be diluted by additional faculty hires, particularly at the senior level as described in the following section.

2) Faculty size

The Minimum Size for Research Active Faculty

Chemistry departments with Ph.D. programs require a substantial infrastructure involving laboratory space that allows safe working conditions for teaching and research laboratories, shared instrumentation for teaching and research, and technical support for instrumentation and laboratory facilities. The faculty size needs to be such that the main areas of the discipline can be covered by the teaching and research expertise of the faculty, new faculty can be effectively recruited and mentored, faculty can be retained, and there is a critical mass of faculty such that the department and university can be competitive in large collaborative research proposals. The faculty size needs to be such that it meets the minimum numbers to be cost effective bearing in mind the substantial investment in facilities and support staff. It is generally recognized that the minimum faculty size should include **20 professorial research active faculty** who can direct graduate students as well as take an active part in the teaching program. This minimum size for research active faculty is compatible with major research universities that have student numbers between 20,000 and 30,000, and is certainly a minimum number.

*The University of New Mexico currently has 16.5 professorial faculty who can direct graduate students, though not all of these are research active. **This is well below the minimum desirable size.***

National Rankings

Universities are classified by various national rankings. The Carnegie Classification of Institutions of Higher Education gives the University of New Mexico the highest category for its research activities, namely “RU/VH” – Research Universities (very high research activity).

A widely used ranking for Ph.D. awarding departments is based upon two reports from the National Research Council, a body established by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine:

- The 1995 report “Research-Doctorate Programs in the United States: Continuity and Change”. This document had rankings on a scale of 0 to 5 for each department in a wide range of disciplines. The higher the number the better the ranking in this report. Unfortunately the University of New Mexico did not provide data for this ranking, so the

Chemistry Department is not included in the national rankings of the 169 Ph.D. awarding Chemistry Departments in 1995.

- The 2010 report “A Data-Based Assessment of Research-Doctorate Programs in the United States”. This document had a series of rankings shown over a range (to reflect uncertainty in the rankings). S rankings were based on how faculty assigned importance to 20 characteristics (with weights that vary by field). The S ranking was calculated 500 times with a different and randomly selected half sample of respondents. The low ranking is with the lowest 5% excluded. The high ranking is with the highest 5% excluded. Thus the average of the high and low ranking does not note the uncertainty in the NRC rankings. In this report the lower the number the better the ranking. The University of New Mexico Chemistry Department was included in this report, showing an “S” ranking (5th percentile) of 50 and an “S” ranking (95th percentile) of 129 giving an average of 89.5.

It is interesting to note that in national rankings such as the National Research Council Rankings the size of the research active faculty is directly related to the ranking of the department. For example, the National Research Council rankings published in 1995 showed that the average size of chemistry departments ranked in the first quartile were greater than those in the second, which were in turn greater than those in the third and again in the fourth.

The number of professorial research active faculty is too small for the department to reach a significantly higher ranking in the national rankings.

Balancing Teaching and Research

Chemistry departments in major research universities often have large numbers of Ph.D. students, and it is not uncommon for the number of Ph.D. students to exceed the number of BA and BS students. All faculty are involved in teaching, but it is normal for faculty directing graduate students to have a 1:1 teaching load (one three hour course every semester). It is not uncommon to have a number of faculty who are instructors and/or lecturers who are only involved in the undergraduate program. Such faculty have a much higher teaching load than that of the graduate faculty (who direct graduate students) and assist in covering the very high undergraduate semester credit hour teaching requirement of a typical chemistry department in a major research university.

The department is doing an excellent job in their offerings for the core program, but it is important that the graduate faculty are involved in teaching these courses.

While instructors and/or lecturers play a valuable role in chemistry departments it is important that the number of graduate faculty are at least at the minimum number discussed above. While it may seem fiscally attractive to have a substantial amount of the undergraduate teaching taught by instructors and/or lecturers since their average salaries are substantially less than the graduate faculty and their teaching loads are much higher, to do so would fail to recognize the central role that a chemistry department plays in a major research university, not only in graduating significant numbers of Ph.D.s in the chemical sciences, but also in interaction and research collaboration with many other disciplines across the university. So many large research projects with their opportunities for major extramural funding require leadership or involvement with the chemical sciences that a strong research program in the chemical sciences is essential

for a major research university. The committee's meetings with leaders in other disciplines strongly supports this point.

Recruitment of new faculty

In order to grow the department graduate faculty to at least the minimum size of 20 it is necessary for the University of New Mexico to engage in a significant recruitment program. It is important to be hiring in all areas of chemistry and at various career stages, particularly mid-career faculty to ensure an appropriate age distribution across the department. We agree with the comments made by some about the merit of considering a long-term hiring plan.

It is important to factor into the recruitment program the need to provide effective mentoring of the new faculty. The new leadership of the department has strengthened the mentoring program, and it is clear that previous department heads did not have a very well structured mentoring program, leading to some junior faculty who have been in the department for a number of years having rather limited mentoring. Effective mentoring is essential to the successful growth of the department and this should include as much internal evaluation of proposals to extramural funding agencies as possible. Consideration should be given to including mentors from other departments when appropriate.

It is important for the department to recruit more female faculty and more minority faculty.

While the department has many minority students, the number of minority and female faculty is small.

It is essential that new faculty be hired with competitive start-up packages, recognizing the different start-up needs in the various areas of chemistry. Failure to provide appropriate start-up packages, coupled with incomplete or absent mentoring has been a significant factor in cases where assistant professors in research universities have not achieved tenure. ***Upper administration will need to assist the department in providing competitive start-up packages, and the department will need to ensure effective mentoring and the selection of faculty research areas which not only fit the department's strategic plan but also the realistic opportunities for appropriate start-up packages.***

Retention and Faculty Evaluation and Recognition

Faculty retention is a key factor in the future success of the department. This will depend upon:

- The department having a collegial and supportive culture.
- The department having at least a minimum faculty size which can be seen as allowing the department to move forward, but also demonstrate the support of the Dean and upper administration.
- The provision of appropriate support for the recruitment of outstanding graduate students.
- An effective method for providing feedback and evaluation of faculty.
- A salary structure which is seen to be fair and which recognizes outstanding instruction and research.

The first two topics have been discussed above and in other parts of this report. The other topics will be discussed in more detail below.

Recruitment of Graduate Students: Effective graduate student recruitment requires a model

where graduate faculty are involved in actively recruiting *for the department as a whole* (and not just for their own research programs). This involves travelling to four year institutions, principally undergraduate institutions (which may have an MS program), and inviting potential graduate students for visits. It also requires a level of graduate student support that is nationally competitive.

We found the departmental graduate committee to be keen to advance the graduate program and we fully support the desire of this committee to meet with the Dean of Graduate Studies every semester. We discussed the issues raised in the previous paragraph with this committee. The Dean of Graduate Studies as well as the Dean of Arts and Sciences will play an important role in ensuring that graduate student support is nationally competitive. In addition the department should continue to try to ensure that graduate students spend as much time as possible after their first year as graduate research assistants funded on extramural grants.

Feedback and Evaluation of Faculty: We are concerned that previous department chairs have had incomplete or non-existent faculty evaluations, and ***we recommend that every faculty member have an annual evaluation and a meeting with the chair*** to discuss the evaluation (which we understand is being done by the current chair). There was also a sense that there could be a lack of clear expectations of what is needed for promotion and tenure.

Salary structure: The salaries in the department vary in the level of competitiveness with other major research universities. The salaries for Assistant Professors are reasonably competitive being in the top 50% of major research universities. The average salaries for Full Professors are in the bottom 50% of major research universities and it is not clear that the salaries are necessarily related to the current level of research and teaching accomplishments.

We did find frustration with the fact that those who had moved into administrative roles were seeing increases while those who were staying in the department and being successful in running research programs/teaching the courses, etc., were not feeling rewarded.

The accomplishments of senior faculty should be evaluated and significant accomplishments recognized. ***It is important that faculty who are achieving at a high level are recognized and that this should be done before any counteroffer issues arise.***

3) Space, Infrastructure and Support:

The **current space occupied by the department is inadequate to meet the current needs of the department** and makes growing the graduate faculty a very difficult matter because of the lack of suitable space.

Recognizing the difficulties in achieving funding for new buildings, it will be necessary to develop innovative ways to meet the short term needs while building a long term permanent solution.

Immediate Issues

The Challenge: New chemistry laboratories have been constructed across the country in recognition of the need to provide safe working conditions for chemical research and teaching and to accommodate modern instrumentation. A number of universities have spent considerable amounts of money to upgrade existing buildings, but in the end the cost of updating existing buildings has proved prohibitive and the disruption to the research activities during these upgrades has been especially damaging. Numerous challenges arise from attempts to upgrade existing buildings, for example the ducting and pumping systems on hoods have a limited life expectancy and can be subject to sudden failure. Attempts to upgrade hood systems in older buildings can be especially challenging because of various factors such as the need to have an effective “make-up” air system which is best in the form of a centralized rather than a localized system. We discuss this further below when we comment on the eventual need for a new building.

Renovations: We were pleased to see that the bond issue was finally funded to provide renovations of Clark Hall, but that is not enough as the current building is not appropriate for modern instruments. In addition, there are deficiencies in the current building that raise serious safety and compliance concerns.

Staff: The current professional staff is inadequate to support the department’s research efforts.

Major Shared Instrumentation: Chemistry departments need major shared instrumentation such as nuclear magnetic resonance spectrometers, X-ray diffractometers, and mass spectrometers. Such instrumentation is often obtained by departmental proposals to major funding agencies such as the National Science Foundation and the Department of Defense. Such proposals almost always require matching funds, and the ***institution needs to be prepared to provide these funds in order for the department to be viable in the future.***

Large Interdisciplinary Proposals: The chemical sciences are often key players in large interdisciplinary proposals, and these proposals frequently require matching funds – again the ***university needs to develop a plan to provide these matching funds.***

Innovative Solutions

We strongly recommend that the department look at the proposed interdisciplinary laboratory space extension to the new physics and astronomy building for additional space. It may be necessary to find temporary laboratory space to grow the department to the minimum 20 faculty, and this space may need to be in other departments or off campus.

Long-term solutions

In the long-term the university will need to work with the department on a solution which addresses a number of issues. These issues include looking at the use of interdisciplinary space

while seeing how best to retain an identity for a chemical sciences program. Practical space issues in many universities have led to faculty in departments working in various widely separated locations on and off campus, and while there are some significant advantages in such developments, there are also issues arising from the dispersal of a department's faculty and a reduction in the interaction between departmental faculty. ***In the long-term a new building is needed for the department***, and such a development will have many benefits including safety, space for growth, improved faculty morale, better recruiting for graduate and undergraduate students, and an ability for the department to better serve the university.

4) Leadership and the Future of the Department

We submit our report at a time when the department is undergoing a major transition. Thus some of our comments reflect on prior practices, so what happened during the last three or four years under Dr. Bear is not necessarily relevant moving forward. Having said that, the successful hiring of several new faculty and the ultimately successful push for resources to renovate Clark Hall under the previous Chair were clearly very important positive developments.

The ***department should develop a new strategic plan*** under the leadership of the new Chair. The department should also look to involving alumni and seeking additional financial support from their graduates. We recommend that the department evaluate the merit of establishing an external advisory board.

It is our distinct impression that ***Steve Cabaniss is off to a very good start as Chair***, a very challenging job indeed in that department at the current time. We consider it crucial that the upper administration provide Steve with as much support as possible. Along the lines of faculty morale and improving the departmental culture, ***we encourage the entire upper administration to meet with the faculty and show that there is indeed support for the chemistry program***. This program is simply too important for a research university.

As the department moves into the future it is important that the department feels that it is fully participating in the development of the departmental future and it is doing so with the full support of the administration. The support from the university and the full participation of the department will see the department grow into an outstanding department that fully serves a major national research university.

Respectfully submitted on July 15, 2013 by The Committee