

# Chemistry Department Response to the Report of the 10 Year Review Visiting Committee

## EXECUTIVE SUMMARY

The review finds the Department of Chemistry at a crossroads. The report and letters state that the Department is "ideally poised for an explosive advance in its level of contribution to the central emerging intellectual disciplines of chemistry." We possess a "great cadre of young and mid-career academicians" giving us "an excellent position vis a vis other institutions of higher current rankings". Certain research areas are "first rate" or "world class". The future research themes are "well chosen and timely." Our undergraduate and graduate instructional programs are "one of the cornerstones of education at the UW." We undertake this program with an "attitude of exceptional service." Our outreach programs "could serve as models for the University's stated goals of increasing community outreach."

However, the reviewers also find that "the situation is fragile, as many individuals are carrying loads that they cannot possibly sustain while moving their scholarship in new directions." The undergraduate program "is sustained by heroism." One reviewer states that, "The faculty workload is miserably high. To expect any kind of improvement in excellence to emerge without attention to the drain in time away from scholarly research and training of graduate students is folly in my view." At the exit interview, an internal member commented that, "The success [of the undergraduate program] of this unit has left them demolished."

If UW is to sustain the scientific and economic development of the state and region, providing to the people of this state the general science education required in a world where science plays an increasingly important role, an increased investment is required. An ancillary benefit will be the stimulation of research in the many fields that now depend for their own advancement on the understanding and manipulation of matter at the *molecular* level. We pledge to work closely with the administration to achieve our shared goal of maintaining and advancing high quality programs.

### Introduction and General Response

We thank the members of the Visiting Committee for their effort reviewing what many believe is the most complex unit in the College. The faculty of the Department have considered the report and how we should respond at six meetings over three weeks.

We believe that the committee has filed a thoughtful report, accurately capturing most of the details of our program. We will move forward on all of the recommendations under our control. A substantive response from the administration will be required if we are to make progress on the high priority recommendations.

We are gratified that the committee concurs with the fundamental thrusts of the self study, that:

- the Department is performing extraordinarily well in teaching, research and outreach, central missions of the UW, and is poised to be of greater future importance, delivering excellent value in proportion to the University's investment.
- the Department's future plans for the pursuit of programs in chemical biology, materials, and environmental chemistry will move both the Department and University forward.
- the faculty, TAs, and staff of the Department are overworked; the instructional and research programs are not sustainable in the absence of additional support. Without this support, maintaining the excellence of our programs will require that we reduce the scope of our mission.

In those areas where the committee found us to be deficient, we will take action, or already have. For example, an ad hoc staff committee, charged in late 1999 with exploring staff issues, made several recommendations, which we have implemented. They concluded that morale was a problem for our overworked clerical staff, who will now benefit from the addition of 2 FTE hired at our own expense. Likewise, the concerns of the environmental graduate students, who number 10 of 190 current graduate students, we now understand, and will act upon, as described below. We have already opened a common room to promote camaraderie among researchers and teachers within the Department.

### The Challenge

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The text of the report states that Chemistry needs help if it is to sustain its programs. The letters of the external reviewers best express the urgency of the situation. The outside reviewers are well acquainted with the workings of a chemistry department, and the national marketplace in which we must compete.

Fleming Crimm, John E. Willard Professor, and former Chair of Chemistry at the University of Wisconsin writes, "The Department is delivering excellent value to the University and has good plans for the future. However, the situation is fragile, as many individuals are carrying loads that they cannot possibly sustain while moving their scholarship in new directions. *The willingness of people to take on very heavy teaching responsibilities has produced the success in the undergraduate program, but it is sustained by heroism. The Department and University must find a way to make the program work in the long term.* [italics added] Only with such a plan in place will the Department make the connections that benefit the entire campus and move its program forward. Without it, the Department will lose ground rapidly on all fronts."

Royce W. Murray, Kennan Professor, former Dean of Sciences at the University of North Carolina, member of the National Academy of Sciences writes, "The faculty workload is miserably high. To expect any kind of improvement in excellence to emerge without attention to the drain in time away from scholarly research and training of graduate students is folly in my view." He goes on to state that, "If the University values having a Department in the poised to improve position that Chemistry is in, and values excellence, it should listen to its problem."

Stephen G. Sligar, Janet and William Lycan Professor and University Scholar at The Beckman Institute of the University of Illinois states, "Two major issues are preventing the Department of Chemistry from realizing a quantum leap in national stature and fulfilling its role of providing the core discipline needed by the clinical and basic science departments of the medical school." The first is that the Department has provided "exceptional service" in a setting which lacks any substantive mechanism for "timely resource flow from the Central Administration". The second is low faculty salaries.

The committee finds that "The chemistry curriculum as it exists today is one of the cornerstones of education at the UW at both the undergraduate and graduate levels..." and that its outreach programs "could serve as models for the University's stated goals of increasing community outreach". However, they identify a mismatch between the Department's mission and the number of individuals who carry this load. The opportunities missed because of this mismatch are many.

We recognize that all departments at UW are under-funded relative to their off-campus peers. However, the committee has argued persuasively that special attention should be paid to this core department that plays a central role in teaching, research, and outreach. First, as the committee notes, there are extraordinary opportunities and burdens associated with teaching the first laboratory science encountered by freshman, who are in transition from high school to college. The University fails when these students are inadequately supported in their entry-level science. Second, the field of chemistry is playing an increasingly critical role in catalyzing advances in many other fields. As the traditional disciplines of science and technology become more interdependent, and as multidisciplinary research grows in importance, a strong chemistry department will be critical if UW is to remain preeminent. Our current situation leaves us as less than optimal partners, inhibiting research campus-wide.

### **The Recommendations**

The committee makes eleven specific recommendations. All are important. Nevertheless, we believe that six of these (1, 2, 3, 5, 8, and 10) are of transcendent importance. The extent to which we can make progress on these items will chart our future course, determining the success on a decadal time scale of our teaching, research, and outreach programs. Substantive action on these items will render these programs not merely sustainable, but primed for advancement. These recommendations call for an infusion of TA lines (1) funded at a competitive level (text section 6.4), an increased faculty count (5), again funded at a more competitive salary level (2), staff lines (1,5), and renovation of outdated instructional and research spaces in Bagley Hall (10). We are encouraged to expand our own efforts to increase our endowment (8). Action on these items, together with existing Department sponsored parties, dinners, open houses, and picnics, and now "Rab's Room" (see below), will encourage departmental camaraderie (3). Moving forward on all of these items is critical to the health of this Department.

Should the University be unable to assist us in addressing the transcendent recommendations, we see two logical alternatives. The first would be for the Department to stay the course in all areas without assistance. Murray calls this folly, and we concur. The second would be for the Department to shed a portion of its mission, reversing what Murray calls our "attitude of exceptional service", which we have nurtured for over a decade. After lengthy discussion and debate, the faculty of this

Department has decided that although unattractive, the only path that would assure the continued quality of our programs in the absence of new resources would be to reduce the scope of our mission.

### Response to Specific Recommendations

- (1) The University administration should provide the resources for 10-20 TA lines to bring the staffing level in CHEM 142/152 up to that of the more advanced service courses and for a staff person to coordinate web-based instruction in the 100-200 level service courses.**

The new TA positions are critical for our program. They would yield a spectacular advance for students, TAs, and faculty alike. It is critical to the future of our graduate program that we lower our TA workload, as this would do. The recommended lowering of the student:TA ratio would allow us to expect each TA to attend the lectures (4 hours per week) *and* teach lab *and* quiz section (4 contract hours per week) *and* grade exams, homework, and laboratory work, *and* invest the time that would advance them from adjuncts to partners in teaching, as recommended in the report.

The number of 9-month TA lines needed to achieve this goal is underestimated: the annual 3700 enrollments in these two courses require 25 or more additional 9-month lines to achieve this student:TA ratio. Unless these new lines are budgeted at a rate higher than TAI, each will require supplementation by Chemistry by about \$2,000 per year. It is far from clear where this will come from.

We would welcome new staff help allowing us to accelerate our incorporation of web-based instruction. The investment would pay huge dividend in both increased student learning and reduced faculty and TA workload. Like many other Departments, we have struggled to accommodate substantial faculty interest in incorporating web resources into our courses at all levels.

- (2) The University administration should provide a salary adjustment for the Chemistry Department faculty.**

This is critical. During the past year alone, three of our most valued colleagues have been courted by competing chemistry departments of superior stature. One member entertained extremely attractive offers from Cornell and Yale simultaneously. Fortunately, all were retained through either counter-offer or preemptive offer. Two additional preemptive offers are being coordinated with the Dean's office as this is written. As Sligar suggests, it would have been less expensive to discourage such interest than respond after-the-fact.

A salary adjustment is also critical to the morale of the entire faculty. The committee notes that the undergraduate program is sustained by heroism. There is a growing sense that such effort is not rewarded at UW. This can only damage our instructional programs if not corrected.

- (3) The Chemistry Department should implement a set of policies designed to promote a greater sense of departmental identity among the graduate students (including those pursuing environmental chemistry) and stronger camaraderie between its faculty, students, and staff.**

We concur, and have already taken action.

It is not unusual for graduate students in the field of chemistry to identify more closely with individuals in their immediate research area than with the department as a whole. But there would be strong benefit to improved camaraderie at the department level, which we have independently identified as a worthwhile goal. Thus, on April 3 we dedicated a new Department common room, "Rab's Room", culminating a year of planning, fund raising, and renovation. We have raised an endowment of \$120,000 to support service of light food items and beverages every weekday at 3:00 p.m. This room is rapidly becoming an important element of our culture.

We will also revitalize our Chemistry Colloquium series which all graduate students and faculty are encouraged to attend. This program has been run sporadically through the years, but as faculty, TA, and staff workloads soared, it became impossible to secure a coordinator for the series, much less an audience. We will attempt to involve the graduate students themselves in selecting, inviting, and entertaining these visitors, increasing their involvement in Department-centered activities.

- (4) The Chemistry Department should consider employing a team teaching approach in its large undergraduate service courses for purposes of standardizing grading practices among the different sections, making more effective use of lecture notes and web based materials, more fully integrating lectures and laboratories.**

Team teaching of introductory courses is an excellent recommendation. These courses create a substantial faculty workload. They include 4 lecture contact hours per week with as many as 288 freshman students. These students are fresh from high school, transitioning from a high degree of dependence on their instructor to the independence required of students at a research university. A significant fraction of these students seek individual help from the faculty member, in person and by email. Helping these students, preparing examinations and homework, and gaining familiarity with the laboratory exercises constitutes the major workload. This load, presently too high for a single research active faculty member, would become tractable if two faculty members shared a single large section, ideally assisted by a lead staff person and a lead TA. This approach is successfully employed not only in peer chemistry departments, but also in some other science units at UW. It requires additional faculty, staff, and TAs, as recommended in the report. To the extent the faculty is expanded, and additional staff and TA help is provided, this approach could be used to lower the teaching workload without lowering quality.

We will take steps to encourage instructors in our introductory courses to share course materials they find to be unusually valuable, establishing a central "depository" for such items. We will also attempt to assemble a databank of useful supplementary material and make this available to the students on-line.

The faculty who are assigned to teach freshman chemistry already assemble prior to each academic year to discuss grading and curriculum. These instructors use a single textbook and reach clear agreement on the chapter coverage in each of 142, 152, and 162. In the interest of exposing students to each instructor's strengths, instructors fine-tune the content of their lectures.

Grade records for our courses show that the mean and distribution of our grades are already quite uniform across our multi-section courses at both the 100- and 200-levels. What is missing, as noted by the committee, is a uniform algorithm by which these grades are determined. We will encourage our instructors to adopt a uniform algorithm to improve the perception of fairness by students.

We will endeavor to improve the degree of integration of our entry-level lectures and laboratories, as well as help students to understand the connection between them. To provide perspective, we note that ten years ago, two of these three laboratories did not even exist. They were established and have until recently operated on a shoestring budget; we are proud of what was accomplished under these circumstances. The advent of laboratory fees provides an extraordinary opportunity for the renovation of these courses, which we have already begun to seize. In fact, our Undergraduate Services Committee has very recently recommended that we reorganize the support structure for the entire undergraduate laboratory program to ensure optimal investment of these resources. New resources would allow us to provide release time to faculty and staff to revamp these laboratory courses.

**(5) The University Administration, in consultation with the Chemistry Department, should develop a contingency plan for dealing with increased enrollment pressures for chemistry service courses that will maintain an appropriate [sic]. This plan should take into account**

- Projections for increases in undergraduate student population during the next decade and other factors likely to impact service course enrollments.
- Strategic plans for faculty recruitment in chemistry and related departments.
- Opportunities afforded by of (sic) web-based learning and other new developments in chemistry education.
- Faculty teaching loads.

Such a plan would be valuable.

It is difficult to project future enrollments in any discipline, because enrollments depend upon many factors, among them the changing fraction of UW students who seek a given course. For example, although the UW undergraduate population was approximately constant during the past decade, both our already large 200-level program and our majors program doubled in size, for different reasons. No one, to our knowledge, could have projected these trends. For this reason, the most practical plan would be one that responded to actual enrollment changes. It would be particularly valuable if such a plan responded to the cumulative impact of modest annual enrollment increases, rather than being triggered only by large changes. Chemistry and our undergraduate students were severely impacted by inaction as our program grew just a bit every year, overwhelming us over time.

Some elements of faculty recruitment are profitably subject to planning, others less so. We can be reasonably certain, for example, that we will need to hire roughly 1.5 FTE of faculty per year to maintain a constant FTE count, as this has been the trend for the past several decades. We can also be reasonably sure that a competitive start-up cost for each hire will be \$300,000 to \$500,000. Defining specific academic needs for future faculty hiring, at least on the multi-year time scale, is less predictable, as continuity of the instructional and research programs requires that hiring be influenced by the

expertise of those who choose to retire. We are experiencing retirement ages ranging from under 60 to ca. 70, with each retirement rarely announced more than one year in advance.

The Department will explore opportunities for web-based learning. The assistance of the staff person whose addition is requested in recommendation 1 will be helpful. Our faculty will continue to keep close tabs on changes in chemistry education.

Our faculty teaching load rose relentlessly from 1987 until roughly 1997, when it was arrested, but not reversed, by addition of several new lines. The report notes that the faculty workload remains "miserably high", going on to recommend a modest expansion of the faculty. We would greatly appreciate a plan that allowed us to expand the tenure-track faculty FTE count by 3 over the next five years.

- (6) Chemistry faculty leadership, together with interested faculty in other departments should develop a written strategic plan for fostering the expansion of biological chemistry, materials chemistry, and environmental chemistry on the UW campus.**

We will be pleased to work in concert with other units to move forward in the thrust areas. We already have a strong track record of coordinating our hiring activities with other departments. Larry Dalton's hire was strongly supported by a variety of departments, particularly in the College of Engineering; his program is having an enormous impact campus-wide. Molecular Biotechnology and Chemistry made a joint offer to a mid-career faculty member in 1998, but the offer was declined. We have just hired Sam Jenekhe jointly with Chemical Engineering, and are attempting a joint hire with Biochemistry. Pathobiology in the School of Public Health is strongly supportive of another senior hire we are considering in the area of chemical biology. Two current, highly ranked ATI submissions involve Chemistry.

- (7) The University administration and Chemistry Department should reach a clear understanding as to whether environmental geochemistry should be developed as**
- a major thrust of the graduate program in the Chemistry Department;**
  - an interdisciplinary program with active participation of the Chemistry department in which graduate students have the option to earn a Ph.D. in Chemistry; or**
  - an interdisciplinary earth sciences program.**

The ability to pursue the first two options would be contingent upon a departmental commitment to give environmental chemistry high priority in faculty recruitment and to address the needs of its current students working in this area. These decisions should also be reflected in updated and accurate information to prospective graduate students concerning opportunities in environmental chemistry research. Students who pursue Chemistry Ph.D.s in these areas should receive equal treatment with regard to departmental resources, opportunities, and responsibilities.

We fully concur. We will update information provided to prospective students of environmental chemistry. All Chemistry environmental graduate students will henceforth be afforded treatment equal to other Chemistry graduate students. Chemistry will continue our efforts to build environmental chemistry through faculty hiring.

While it is more important to shape the future of environmental chemistry at UW than to dwell on the past, the origin of the current situation is worth briefly recounting. It is not mere chance that Chemistry has attracted a larger pool of graduate students with interests in environmental chemistry than can be advised by the faculty of Chemistry. This was the *explicit goal* of a program approved by Chemistry in 1993, advocated by Professors Charlson (then in IES and Atmospheric Sciences) and Gammon (Chemistry and Oceanography). This program aimed to use Chemistry as an entry point for graduate students interested in environmental geochemistry, a large fraction of which would pursue thesis research in the graduate programs of other departments. The plan called for the program not to create new financial obligations for Chemistry, but in the end it has. Our clumsy attempt to limit this obligation, by giving all graduate students (not just environmental) working for PIs outside of Chemistry lower priority in the allocation of TA lines has unfortunately, but in hindsight understandably, been misinterpreted by environmental graduate students as being punitive. These students are dismayed that Chemistry efforts to hire new faculty in environmental chemistry have had neither the urgency nor narrow focus on environmental geochemistry that would be expected if it were our goal to put in place Chemistry faculty to mentor this group of students. We have been told that some faculty in other departments have come to view their role as mentors of these students as "bailing out Chemistry"; Chemistry, in turn, thought that it was providing a service, not a burden, by bringing these students to campus. The existing program has thus been not entirely satisfactory to UW students or faculty. A new course is clearly needed.

We propose that the UW pursue the second of the two options stated in the recommendation, that environmental geochemistry should be an interdisciplinary program with active participation of the Chemistry Department in which graduate students have the option to earn a Ph.D. in Chemistry. The relatively new GEC program will presumably play an important role in such a program. In the future, Chemistry will admit only the number of graduate students in the area of environmental chemistry that matches the interests of our faculty in this area and their ability to provide financial support.

The Department will pursue the goal described in the self-study, and endorsed by the review committee, to pursue environmental chemistry as one of three thrust areas within the Department. We define environmental chemistry broadly, including some subject areas that may be uniquely of interest to chemists, such as homogeneous and heterogeneous catalysis and benign organic synthesis. We view hiring the right individuals to be more important than hiring individuals quickly. This approach served well our effort in materials chemistry, which took a decade to nucleate, but was worth the wait.

- (8) The Chemistry department should be encouraged to expand upon its highly successful development efforts and to devote these funds to providing some of the kinds of programmatic and facilities embellishments that are hallmarks of top



ranked chemistry departments. Among the items that might be considered are supplements to the startup packages for new faculty.

We thank the committee for acknowledging a successful decade of development activities. Indeed, a healthy endowment that supplements a state budget that covers baseline instructional costs would assure our future success. Our development activities will expand in concert with those elsewhere on campus, as the campaign gets underway.

We are pleased that the committee concludes that Chemistry should not have to use its endowment to cover baseline instructional costs, such as paying TAs a competitive wage (text section 6.4). We will continue to use our endowment to supplement new faculty startup costs.

- (9) **The Chemistry Department should formulate clear descriptions of the job requirements and standards for chemistry education faculty and use these standards as the basis for merit raises. Of particular importance is clarification of the role of the faculty in undergraduate teaching versus chemistry education and K-12 outreach.**

The Department will formulate clear descriptions of the job requirements for the lecturers and use them as the basis for merit raises. It is relevant here to point out a fundamental conflict at the center of which is the Department and the lecturers. The Dean's office provides lecturer lines to Departments with large undergraduate programs, with the expectation that these individuals have as their main mission undergraduate education. The central administration espouses the importance of outreach activities, at which our lecturers are outstanding. We note with pride that Senior Lecturer Deborah Wiegand has recently been named the first recipient of the coveted S. Sterling Munro Public Service Faculty Award. Outreach activities thus represent for us yet another important mission for which no support has been provided. We wish to continue our outstanding outreach activities, but require assistance.

- (10) **The Chemistry Department and the University Administration should continue with the systematic renovation of the laboratories of Bagley Hall. Cosmetic upgrades to teaching labs in most need of renovation should be implemented immediately.**

We would welcome a program of systematic renovation of instructional and research spaces in Bagley Hall. We would be extremely eager to participate in planning for the renovation of the instructional and research spaces. It is important for the administration to understand that the spectacular new Chemistry Building meets the needs of only a fraction of our students and faculty.

- (11) **In response to the department's desire to increase the number of graduate students per faculty member, the Graduate School should allow the department to increase its graduate student enrollment contingent upon the availability of departmental research assistantship support and space. The number of teaching assistantship lines assigned to the department should be based, not on the department's need for the support of graduate students, but on the needs of its instructional programs.**

We are pleased that the committee has chosen explicitly to state that for this Department, TA lines should be added because the instructional program requires them. Analysis of the grant and contract support budget, TA budget, and graduate program size for our department and off-campus peers reveals that it is the TA budget of this Department, not than the grant and contract budget, that constrains the size of our graduate program relative to the peers.

### **Conclusion**

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We are extremely pleased by this highly supportive review. We will use the criticisms of the committee to improve our programs, responding substantively to all of those recommendations under our control. We are an ambitious department, aspiring to move forward. We wish to become the 7<sup>th</sup> best public department of chemistry in the nation, 15<sup>th</sup> among publics and privates, a 90<sup>th</sup> percentile ranking by 2010. We believe that in partnership with the central administration, we can do so. We look forward to working closely with the administration to chart a course that is positive for all of the teaching, research, and outreach programs of Chemistry.