Date: May 24, 2011
To: Provost Ray Coward
Re: Response of the Department of Chemistry and Biochemistry and Dean of the College of Science to the external review committee report

Dear Provost Coward,

The Department of Chemistry & Biochemistry is grateful to the external review committee, Paul Cook, Tim Gilbertson, and Mukund Sibi, for their dedication and their work in critically assessing the department’s strengths and weaknesses. We appreciate their investment of time during the site visit in meeting with faculty, staff, and students, examining the physical facilities, digesting a large amount of information, and for their thoughtful review.

I. Strengths.

We note that the review committee viewed favorably the reorganization of the department into thematic research areas and the de-emphasis of traditional divisional groups. The first hire has been made from a search that used this approach, a chemist whose research enhances our catalysis and mechanism focus and simultaneously addresses the shortage of faculty members with inorganic chemistry teaching expertise. This individual’s research will appeal to graduate students with interests in organic or inorganic chemistry.

We are pleased that significant numbers of both undergraduate and graduate students made time to meet with the review committee and actively engaged in discussions. Graduate students expressed a high degree of satisfaction with their education and mentoring, and undergraduates are particularly pleased with their laboratory experiences. The department has several upper division laboratory courses that incorporate significant discovery-based activities in which students work in small groups, reflecting an authentic research experience. More recently, within the past year the general chemistry and organic chemistry laboratory syllabi have been revised. This was done, in part, to bring students’ laboratory explorations into better synchronization with the coverage of topics in their concurrent lecture courses.

We concur with the review committee’s opinion of the physical infrastructure, particularly the excellent facilities in the Widtsoe building. The research laboratory space is first class, and the teaching laboratories for general and organic chemistry are excellent. These facilities provide our students with environments that are safe and well-designed for effective research and education.

II. Concerns and Recommendations

The review committee raised several issues that require attention for the department to remain productive. Many of these are areas of longstanding concern, and are the focus of actions that are either underway or planned. A number of the activities underway follow recommendations in the report.
Graduate student recruiting and retention.
This may be the most critical issue facing the department. With recent successes in grantsmanship, many faculty members now lack the number of graduate students they need to carry out funded research projects, jeopardizing the prospects for continuation of this success. In the early to mid-2000's the department had an average of roughly 50 graduate students, compared to 29 at present. The small size of the department presents a challenge to graduate recruitment, as prospective students see fewer research options compared to competing departments. This aspect will improve as faculty numbers recover. In the meantime, the department is instituting more aggressive graduate recruiting efforts, with two major activities underway.

• In fall of 2010 and spring 2011, five faculty members made graduate recruiting visits to eight targeted potential feeder schools. Many of these schools have one or more faculty members who are graduates of our doctoral program. We also targeted schools in our geographic region, to take advantage of the desire of many Utah students to remain close to home for their graduate work. The schools visited were: Southern Illinois University at Edwardsville; Pacific University; Idaho State University; BYU-Idaho; Western Washington University; Weber State University; Southern Utah University; and California State University at Chico. We plan to continue to visit these schools on an annual basis.

• We have initiated a summer internship program for selected prospective graduate applicants resulting from the visits described above. This summer, six students will each spend up to ten weeks in a research laboratory in our department. The department covers housing, taking advantage of low summer campus housing rates, and a modest stipend. Students who are deemed particularly desirable prospects will be made a provisional offer of acceptance into our graduate program before they leave (pending a full application and acceptance by the graduate school, with the department covering the application fee). Success of the program will be measured by monitoring how many internship participants apply and ultimately join our graduate program.

The funding for these activities comes from the College of Science, which provided $20K per year for two years to enhance graduate recruiting, as part of the department head change in late 2009. The department will use internal funds, including overhead return, to continue them. As recommended by the committee, we plan to apply for a summer REU grant from the NSF to continue and expand the summer internship program.

The committee recommended that we increase enrollment of international students, and that we enhance existing connections and develop new ones with international universities. In Fall of 2011 we will host a visiting professor for one month from the People’s Friendship University of Russia, which has sent a number of outstanding students in physical chemistry to the department in recent years. During this visit we hope to expand this relationship to facilitate students coming to USU in other areas of chemistry. There are also plans for the department head and a faculty member to visit the chemistry department at Nankai University in China, another department with which we have an ongoing relationship and that has been the source of several doctoral students.

In Fall 2011 twelve new graduate students will join our program. This is the largest incoming class in recent years, and results in part from the above efforts to bolster our graduate program.

Loss of faculty.
As faculty lines become available, the department will continue to select from our strategic research areas for new faculty searches. This is a break from the tradition of searching by classical chemistry
division, and will encourage applications from interdisciplinary candidates. This approach was successfully used in the most recent search, described above.

We note that many of the recent funding successes in the department are for projects that involve collaborations. Recognizing that funding agencies are not only encouraging an interdisciplinary approach in funding applications, but in some cases demanding it, the department has pursued the development of a chemical biology emphasis area within our graduate program in conjunction with the biology department. A faculty position has been allotted for this program, and will be filled by a candidate housed in one of the two departments, and who will have potential research collaborations in the other.

The department will also be the home department for a member of the VDID USTAR team, and is actively involved in seeking a candidate to fill this position.

**Lack of undergraduate research opportunities.**
This problem has grown acute, as the total number of undergraduate majors in the department has doubled since the establishment of the biochemistry major in 2005, when the department had four more faculty members than present. The department is taking steps to better inform our students about undergraduate research opportunities in the laboratories of faculty in other departments whose research involves chemistry or biochemistry. We have a process in place for students to register and receive credit for undergraduate research (CHEM 4800) in these cases.

Several of our upper division laboratory courses incorporate multi-week, discovery-based projects that give students an undergraduate research type of experience. These are the Advanced Biochemistry Lab, CHEM 5720, taken by all biochemistry majors; and Instrumental Analysis Lab, CHEM 5650, and the Advanced Synthesis Lab, CHEM 5530, taken by chemistry majors. This part of our undergraduate curriculum insures that all of our majors get experience in team-oriented, problem-solving and critical thinking skills in a laboratory setting that is analogous to an undergraduate research experience.

**Undergraduate laboratory offerings.**
As the review committee noted, the general and organic chemistry laboratory and lecture sections are oversubscribed. Although the final enrollments in the lecture sections were slightly under capacity due to late drops, at the beginning of fall semester the waitlist of students for the general chemistry courses Chem 1010 and Chem 1110 were 25 and 31 respectively. The number of students unable to register for Chem 1210, the general chemistry course needed by science majors, was uncertain because this course is not available for wait-listing (due to complications arising from accompanying recitation sections).

We agree with the review committee that the addition of evening laboratory sections of general and organic chemistry will be inevitable as the university’s enrollment continues to increase. This will expand the laboratory management responsibilities. After the loss of our lab manager position to budget cuts, our lecturer, who already had a full load of classes, took on these duties for general and organic chemistry labs; upper division labs lost laboratory manager support. The review committee recommended that the administration provide funds to restore the laboratory manager position.

An alternative solution can be considered. Growing university enrollment will soon require additional sections in both lecture and laboratory service courses to meet demand. A second lecturer in the department would allow us to cover both needs. In addition to a classroom teaching
assignment, one lecturer might cover the general chemistry labs and upper division chemistry labs, and the other, the organic and upper division biochemistry labs. As enrollments increase, this will allow the department to maintain the high quality of the undergraduate laboratory experience that many students favorably commented on to the review committee.

**Limited options in graduate coursework.**

Our reduced faculty numbers make it difficult to offer courses beyond our core requirements on a regular basis. In the coming academic year we will offer a graduate level bioinorganic chemistry course for the first time in three years; this was facilitated by the recent hire of a new faculty member who will alleviate the teaching shortage in the inorganic chemistry area.

The review committee shared with us a proposal for partial-semester special topics courses. This may be a more feasible way to offer periodic mini-courses on important but non-core topics. Another possibility is to use adjuncts and a team-teaching approach to offer periodic special topics courses. This will require identifying a source of funds to pay adjuncts for their services. Still another possibility is to offer a short course in conjunction with one or both of the named lectureships in the department. Currently a distinguished speaker visits the department for a day and delivers a widely advertised seminar. For some additional compensation, we may be able to ask individuals to spend another day or two and deliver a tutorial in their area.

**Research infrastructure**

We concur with the assessment of the review committee about the need to update our NMR capabilities, and for the university to establish central Mass Spectrometry capabilities. The department has successfully used the NSF MRI (Major Research Instrumentation) and the CRIF (Chemical Research Instrumentation Fund) programs for major equipment proposals in the past. We note that the CRIF program has been temporarily suspended due to budget cuts; the MRI program is limited to two proposals for instrument purchase per campus, and thus we compete campus-wide for access to this program.

Most recently, we submitted a proposal in 2009 for a 500 MHz NMR spectrometer to the MRI program. In contrast with our previous success in this program, the proposal was not funded; the major criticism was an insufficient critical mass of investigators who needed the instrument. This proposal had co-PIs from within and outside the department, but the projected user base reflected the diminished faculty numbers in our department and around the university. Since then, the university has hired two USTAR faculty members who need NMR, and the new faculty member hired within the department will need this facility as well. A resubmission of this proposal will take advantage of the larger number of both established and young investigators. The department has a highly qualified and effective NMR director, a position funded in part by the VPR office. This position has allowed us to broaden the user base for the NMR facility over the years. This user base now includes as many users outside our department as inside, a fact that will also help our prospects for funding. If and when the CRIF program is restored at NSF, we will submit a proposal there for our NMR upgrade.

The Mass Spectrometry issue is a serious one that will be more difficult for the department to solve on its own. There are a number of MS instruments around the campus for small molecule analysis. However, life sciences research requires the ability to analyze biological molecules; a host of MS-based analytical methods are in wide use by researchers around the world in the life sciences. There is an excellent LC-MS instrument in the CIB, but no MS expert is in residence. As a result of the absence of operator expertise, few samples are submitted to the CIB for MS analysis. Instead, USU researchers seek out collaborators and go off-campus for MS capabilities (at significant cost),
or simply go without and resort to less satisfactory but locally achievable alternatives. Our department has twice submitted proposals to the NSF MRI program for an LC-MS instrument to be housed in our own department. These proposals included co-PIs from our own department and from biological engineering, and had a projected user base that included members from three other departments. The proposal included a plan to send our NMR director for MS training and to use the director of the University of Utah MS facility as a consultant. The proposal received very good reviews (a mix of excellent and very good) but was not funded, due to a serious concern among the review panel that in the absence of a dedicated MS expert in residence to run the instrument, it would not be effectively utilized (in fact, this is precisely the situation with the CIB instrument). Discussion with the NSF program director indicated that the absence of such an existing position, or of an institutional commitment to fund one, is viewed as a significant weakness in a major equipment proposal. If the university can find a way to establish a position for a director of a central MS facility (which is the norm at every research university of which we are aware) the department is ready to assist in grant proposals to obtain instrumentation needed by investigators in this and other departments.

Respectfully submitted,

___________________________________
Alvan C. Hengge, Head
Chemistry & Biochemistry Department

____________________________________
James A. MacMahon, Dean
College of Science