

Department of Chemical and Biological Engineering
University of Wisconsin – Madison
Report of the Visiting Committee

2010 Visit (April 25 & 26)

Introduction

The visiting committee of the Department of Chemical and Biological Engineering met in Madison on April 25 and 26 with 8 of its members in attendance (see membership Table in the Appendix). The agenda of the meeting (also attached as an appendix) included presentations of the departmental leadership to the full committee on key topics (i.e., state of the department, department's strategic plan, undergraduate curriculum and laboratories, research centers and alumni interactions), subcommittee meetings with important constituencies (i.e., undergraduate students, graduate students, and junior faculty), discussions among the committee members in executive sessions, and finally, a meeting with Dean Paul Percy of the College of Engineering. Limited feedback was provided to the department faculty in a short session at the end of the meeting, with more details included in this written report.

Departmental Overview

The visiting committee is very impressed with the Department's accomplishments in all aspects of its academic life and responsibility. In the eighteen months since the last committee visit, the Department has made significant steps in developing a very compelling strategic plan, while it continued to advance its educational and research mission and to address effectively organizational and operational challenges.

National and international rankings for several decades have been placing the Department of Chemical and Biological Engineering among the academic leaders in the discipline. The "State of the Department" presentation made by the Chair to the visiting committee provided clear evidence in support of this position. Research productivity metrics continue to be impressive – placing the Department at or near the top of the corresponding departments at peer public and private institutions – and are consistent with the impressive list of national and international awards made to several faculty members since the last visit. The visiting committee was particularly pleased with the number of doctoral degrees awarded, as well as the recent increase in external research funding.

The department also continues to balance its excellent research and doctoral education program with a dynamic undergraduate program. These efforts reflect the strong commitment of the faculty to undergraduate education and their dedication – especially that of a subgroup of faculty members – to the unit’s educational mission. The committee noted the impressive increase in undergraduate enrollments and fully supports the department’s initiatives to integrate computational tools in the undergraduate curriculum and to develop a new Biomolecular Engineering Laboratory course, consistent with current trends in the discipline. The committee also applauds the on-line offering of a “bottleneck” course (CBE 250), that allows transfer students from the UW system to make a later transition to Madison with clear social and financial benefits for them and their families. Such initiatives are consistent with the mission of a flagship state institution and can go a long way in creating goodwill and support from key state constituencies.

The working environment in the department continues to be very collegial. Extensive faculty research collaborations are evident in most areas – especially those supported by the externally-funded Centers – and are recognized by the committee as one of the biggest strengths of the department. The increasing demand on teaching activities, resulting from the increased enrollments, has been handled so far equitably, with faculty members with smaller research programs shouldering most of the extra load. However, for maintaining an excellent environment into the future it is critical that these faculty members are appropriately recognized for their educational contributions. The new Chair, Professor Nick Abbott, has made progress towards improving the department’s relationship with the College, a concern identified in the previous visit’s report. Administrative challenges associated with reduced budget have been handled so far without a significant effect on productivity, although the committee agrees with the department that a limit has been reached and without additional staff support research and teaching output may suffer.

Recommendations from Last Visit

The committee is pleased with the actions taken by the department in response to the recommendations made in its last report. More specifically:

1. The department has been engaged in a strategic planning effort, as recommended by the committee. The results of this effort are discussed in more detail in the next section. Overall, the committee was very pleased with the progress made in this area.
2. The department has continued its efforts to align its goals with those of the College of Engineering and to communicate effectively with the College and Dean regarding the department’s challenges and needs. Issues related to the College of Engineering and University environment are addressed in a separate section below. The department has also continued its efforts – within its power – to secure additional resources as

recommended in the last report. The committee continues to have concerns in these areas, but it also believes that such concerns cannot be addressed unilaterally by the department.

3. The department has presented benchmark data indicating that the number and percentages of female students receiving either BS or PhD degrees in Chemical and Biological Engineering are well within the range of numbers reported by peer institutions (especially flagship public Universities). Hence, it appears that the data do not support the committee's previous concern in this area. Nevertheless, the committee encourages the department to continue its successful efforts in diversifying its student body.
4. The department has addressed all minor issues raised previously by students and junior faculty to the satisfaction of the committee.

Strategic Planning

Following the 2008 visit the committee recommended that the department should engage in a strategic planning effort that should result in a plan outlining the core academic values of the faculty as well as their vision and goals for the future. The visiting committee is very pleased with the department's response to this recommendation. Indeed, such a planning effort took place during the eighteen months since the last visit and a strategic planning document was produced and presented to the committee.

The plan starts with a thoughtful analysis of current trends – educational, societal and operational – that directly affect the chemical and biological engineering discipline, and continues to clearly define the department's mission and vision and to set a number of goals for the future. The committee was impressed with the comprehensive presentation of the drivers of change in the discipline and the reduction of these drivers to the local level. The committee was also pleased with the department's selection of guiding principles (or as the committee called them in 2008 "core values"), which are consistent with the expectations from an internationally recognized powerhouse in the discipline. Finally, the committee was pleased to see that leadership/citizenship at the local level and an outstanding faculty environment have been included in the guiding principles, since these represent enabling conditions for sustainable high level productivity in the research and educational arenas.

The committee applauds the department for identifying a set of "diverse experiences" as a critical component that brings flexibility and vitality to the undergraduate curriculum and encourages the faculty to continue to develop and add such experiences to the available inventory. It further noted the strategic plan efforts to leverage synergies between the graduate and undergraduate programs and fully agrees with the faculty that achieving such leveraging is important for future success.

In terms of research the plan identifies three focal areas (i.e., energy and sustainable engineering, advanced nanoscale materials and biotechnology) which are consistent with the current expertise of the faculty and fairly well aligned with the list of grand challenges identified by the National Academy of Engineering for the next century. In the opinion of the committee these are good choices for the department. The strategic plan also calls for a very modest increase in the faculty size over the next 5 years and the establishment of a federally-funded center in energy, catalysis and sustainability within the next decade. These are viewed by the committee as “safe” goals and the department is encouraged to consider a more aggressive strategy. Especially in the case of a new Center, the timeline will probably have to be moved up, since one of the two existing Centers – which has had a tremendous positive impact on the department – is already past its half-life time from a federal funding perspective.

The plan also addresses some operational and governance issues. The committee believes that these are good steps that will most likely improve the working environment and the efficiency of the unit. Most surprising to a number of the committee members was the identified need to establish written statements of responsibilities and expectations for the different staff positions, since these are frequently covered elsewhere by state employment rules. In the absence of such rules at UW, the committee commends the department for taking the initiative to establish such procedures.

The single point of concern identified by the committee in the strategic plan is associated with available resources. As pointed out in the discussion regarding the department’s relationship with the College and the University that follows below, it is not clear to the committee how new efforts are incentivized financially at UW and the extent to which performance and resources are linked. Unfortunately, this does not appear to be clear to the faculty as well and the allocation of new resources (or even the reallocation of existing resources) from the faculty’s perspective depends on the “goodwill” of mid and upper level university administrators. If indeed this is the case, then such a model undermines any serious effort of strategic planning in which the achievement of certain academic goals should be also related to financial gains and incentives.

Overall, the committee expresses its great satisfaction with the faculty’s efforts in the strategic planning area. It encourages the faculty to assess on an annual basis the progress towards meeting the established goals and to continue to examine and revise the plan on a regular basis, since in the committee’s collective experience successful strategic plans are “living” documents capable of adjusting to changing conditions.

Subcommittee Meetings

Undergraduate Students: The subcommittee met with four undergraduate students (all seniors). A wide variety of topics was covered during the discussion, including the overall educational experience, curriculum, and quality of teaching and advising. Overall, the students

reported that their educational experience was excellent. Three of the four stated that it exceeded their expectations, while the fourth believed that while the experience was challenging it met/exceeded her expectations as well. All reported that they have secured employment positions, three in Wisconsin and one in Georgia. They believe that their coop/intern experiences assisted them in securing these positions. They commented, however, that their advisors did not stress the importance of interning to securing a permanent position. Three of the four students took the opportunity to do research during their undergraduate experience and reported the experience to be very positive and to have helped them prepare for their future careers. They recommend that these opportunities be promoted more by the faculty, since in all cases they found these positions on their own.

The students, when asked, expressed a concern about increased enrollments. They were aware of the current trend and had even heard that the current increases may lead to a “cap” on the growth. When asked about the size of their classes, they commented that they like the smaller class sizes of 15-30 students. In this type of environment they got to know each other over time and received help from one another. They are worried that unless additional faculty or instructors are hired, the quality of the educational experience will decline with increased enrollments. They also believe that increasing class sizes to over 50 students would be detrimental to the quality of the program and reiterated how important the small class size is to them.

With respect to the curriculum, the students reported that the coursework was demanding, but expressed this opinion in a very positive way. Three of the four are graduating in four years, while the fourth will graduate in nine semesters because of a coop experience. They reported taking a slightly lighter course load than average students in other disciplines, because of the demanding nature of the CBE curriculum. Nevertheless, they will be graduating on time because of the significant number of Advanced Placement credits acquired in High School.

The students appreciate the redesign of CBE 255. Some of them commented that CBE 426 was one of their favorite courses and all of them (including the one student who took the lab abroad) pointed out that the summer lab was quite successful and well run. They further expressed the opinion that cost concerns are the main reason prohibiting more of them from considering the overseas lab. Professional Depth Credits were also singled out as being very positive. CBE 470 was identified as the one course needing attention. The students reported problems with the equipment (even after they received help from the instructor or another faculty member) and they believe that the three credits awarded in this course do not properly reflect the amount of work required. The students also reported that they would be very interested in more business course opportunities, especially if such courses would be related to entrepreneurial activities. One student commented that he was taking a history course pass/fail simply because he needed to fulfill a degree requirement. He would have preferred to focus more on business learning instead. Furthermore, none of these students had any economics courses, an area believed to be important in the preparation of engineers by many companies.

Overall the students were satisfied with the quality of teaching and reported that they had many positive experiences with excellent teachers and instructors. They specifically mentioned their positive experience in the small lab teams (despite the heavy work load required in many cases) and expressed the opinion that most lab courses were well run and had quality equipment and setup. They do believe however, that there are significant differences in teaching technique and quality between instructors. Students appear to “know” the instructors’ reputations and frequently they attempt to schedule or select instructors accordingly.

One area where the students expressed concerns was the department’s approach to academic advising. None of these students had any face to face advising with faculty during their four years at UW. One had used an email process and was disappointed by the perceived lack of interest in scheduling a face to face meeting. They also expressed the fear that advising would become even more difficult in the near future as enrollments continue to increase. In contrast, the students reported very favorable past experiences with the Career Services, both in terms of professional advising and preparation for interviews. They believe the Center to be extremely well managed and had no suggestions for improvement. They did comment that it would be helpful if faculty recognized when career days or job fairs were held on campus so that they would support student attendance, since these events occasionally conflict with class schedule.

Graduate Students: The subcommittee met with seven graduate students, ranging in experience from first to fourth year. The students had a diverse background in terms of their undergraduate institutions and the type of research they are engaged in. Overall, this was a very positive meeting, with the students expressing a high level of satisfaction with their educational experience in the department.

Several positive aspects were identified by the students. Meaningful and extensive collaborations between research groups, both inside the department as well as with other departments on the UW campus, were mentioned as a strong positive. The students believe they benefit from such collaborations since they are exposed to more than one research philosophies and methodologies. They also identified existing contacts with the industry and the diversity of research foci and faculty personalities as beneficial elements that enrich their graduate experience. They are aware and very appreciative of the department’s international reputation. They are also satisfied with the communications with the department and have the feeling that communication channels are constantly open. Finally, they expressed a satisfaction with the relatively recent change in the PhD qualifying exam, although it appears to the subcommittee that the process is still ongoing.

One concern raised by the students is a perceived gap between the chemical and biological engineering components of the department. They pointed out that collaborations between these two “halves” are limited both in terms of research, but also in terms of educational activities. While the first appears to be more difficult to achieve, with respect to the second the students pointed out that the department should take advantage of the biological engineering

opportunity to provide a broader education to those among them oriented more towards traditional chemical engineering careers. Nevertheless, this should not be done at the expense of a desired rigorous curriculum and an effort needs to be made to strengthen the core biological engineering graduate course, which is perceived by most of them to be “much easier than the other core courses”. Finally, the students reported that in their opinion academic advising is inconsistent across the department and greatly depends on the personality of the research advisor. They believe that sometimes students are given incomplete or incorrect information – especially with respect to the preliminary exam – and they would prefer to see more consistent advising and more uniform enforcement of departmental policies across the board.

Junior Faculty: First and foremost, the junior faculty asked the subcommittee to convey to the department a high level of satisfaction with the current work environment. The junior faculty members believe that they have a voice in the department and are treated with respect from their senior colleagues. When asked for a single point which they would like emphasized, they noted that they would like to see more hiring at the junior level to create critical mass in their respective fields at the University of Wisconsin.

Other issues were also discussed, some under prompting by the subcommittee and others spontaneously brought up by the junior faculty. The junior faculty reported for example, that the physical plant for research and education is outdated. The department is housed in an older building, which gives an obsolete feel to the space. This affects classrooms and both teaching and research laboratories. They believe that an upgrade in the facilities could have a significant impact on drawing the best doctoral students, as they have to compete for such students even with other faculty members (especially bio-focused faculty) on their own campus. Office space is also insufficient, with the department being at 98% capacity. In fact, one junior faculty member noted a 9-month wait period for desk space for a student working in his laboratory from another department.

The junior faculty members also believe that stronger representation is needed by the department in University-wide committees and such representation could have a positive effect on their development. They mentioned for example, that the selection of proposals for major awards from private foundations and/or the state is decided at the University level and sometimes these decisions are driven by senior faculty members from other departments supporting faculty from their own units.

Finally, the junior faculty members noted that their start-up packages were relatively low, but the presence of training grants and other sources of funding augmented these packages to give them the support needed to be successful in their research efforts. They reported that both pre- and post-award support has improved dramatically in the department over the past 6 months. They also mentioned that they have been encouraged to pursue opportunities to work with industry, since such collaborations may bring to their attention problems of tremendous relevance to which they could contribute. Nevertheless, the current industrial relationships are

few among the junior faculty, as the need to publish may be restricting or constraining to some extent such collaborations.

COE and University Environment

The biggest concern expressed by the visiting committee in the 2008 report was the relationship between the department and the College of Engineering. The committee was unpleasantly surprised by the lack of alignment between the goals and aspirations of the college and those of the department. The committee further reported that the apparent lack of focus by Dean Percy on graduate education and research was troublesome, especially since in academia these are reputational drivers that directly affect the undergraduate programs. Finally, the committee was also troubled by differences in perspective with respect to finances, especially since it appeared that what the Dean considered “enormous investments” in terms of start-up packages for new faculty, clearly falls below market competition in the field of chemical and biological engineering. This environment, in the opinion of the 2008 committee, represented a threat to the department’s international reputation.

The department closely followed the committee’s recommendation and made a strong effort over the last 18 months to align itself more closely with the college. The change in departmental leadership – which usually comes with a change in style and approach – and the strong participation of the faculty in the undergraduate education activities (e.g. grand challenges courses, honors program, new distance ed courses) appear to have contributed to an improvement in the relationship between the department and the Dean. In this respect, the committee is pleased by the progress made. However, these represent small steps and several important concerns remain unresolved.

Central to these concerns are budgetary issues. The committee lacks a comprehensive view of the departmental and college finances that would allow for a more meaningful discussion. What is troubling, however, is that the faculty and leadership of the department also appear to be lacking such a perspective with respect to college and university finances. This indicates to the committee that the financial decision making is not transparent to this academic unit. Furthermore, it appears that no financial incentive system is in place, since despite significant increases in both undergraduate enrollments (directly related to tuition income for the university/college) and research expenditures (once again, directly related to indirect cost returns for the university/college) the Department has not seen its budget affected and has not been allowed to hire a new faculty member since 2007.

The committee heard that graduation instead of enrollment numbers may be used as a metric by the college. If this is the case, then such a metric should be reconsidered, because it trails workload requirements for the units by several years. In today’s financial environment, where timely decisions and ample flexibility are required, such an approach is questionable. The

committee also heard that indirect cost returns are mostly sequestered centrally by the University and no such returns trickle down to the unit that generates them. Once again, without a more comprehensive understanding of the financial model, it is difficult to pass judgment on such a decision, but the fact is that without systematic reinvestment and leveraging, the whole research operation of the department is at risk.

The committee expressed some of these concerns to Dean Peercy during a one hour meeting with him. It reiterated to the Dean its strong desire to assist the department and, consequently, the college and the university. In this respect, the committee pointed out that it recommended to the department the development of a strategic plan that will achieve better alignment with the goals of the college (i.e., his goals) and is pleased with the progress made in this direction. The Dean indeed acknowledged the department's efforts and indicated a good level of satisfaction with the department's involvement in the college's undergraduate initiatives.

However, beyond this point, the discussion did not reveal how Dean Peercy planned to address the financial issues outlined above. The committee also appreciates that not all financial decisions that impact CBE are under the independent control of Dean Peercy. Nevertheless, the committee remains concerned regarding the lack of attention at the College level to the complex interrelationships between undergraduate and graduate education and research that define a top-tier department. It encourages the department to continue its efforts to develop synergies between graduate and undergraduate education and to thereby serve as a model for the college and university administrations to follow.

Summary of Recommendations

In closing, the committee concludes that the department's academic profile and accomplishments continue to be consistent with its outstanding national and international reputation and congratulates its faculty and leadership for their performance. In addition, it offers the following recommendations that could lead to additional improvements.

1. Use the newly developed strategic plan for the department to guide your short and long term decisions and evaluate on an annual basis your progress towards achieving your stated goals; discuss the financial aspects of the plan with the college administration and try to reach an agreement on how these can be managed.
2. Continue to communicate to the college and university administrations your accomplishments and needs; benchmark your finances against peer institutions to establish an understanding of the resources that are needed for continuous reinvestment in the department.
3. Examine the root causes of the dissatisfaction expressed by some undergraduate and graduate students with respect to academic advisement; consider developing a different model of academic advising in the department.

4. Consider adding more flexibility to the undergraduate curriculum – especially with respect to electives – while maintaining a relatively small class size; further consider a better integration of the chemical and biological engineering core courses at the graduate level.

Respectfully submitted on October 4, 2011 by:

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DEPARTMENT OF CHEMICAL AND BIOLOGICAL ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

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APRIL 25 – 26, 2010

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DEPARTMENT OF CHEMICAL AND BIOLOGICAL ENGINEERING
UNIVERSITY OF WISCONSIN-MADISON

**2010 Visiting Committee Meeting
Agenda**

Sunday, April 25, 2010

- 6:00 P.M. - 6:30 P.M. Reception (Capitol Club, 14th floor, Hilton Madison Monona Terrace)
- 6:30 P.M. - 7:30 P.M. Dinner (Hilton)
- 7:30 P.M. - 8:00 P.M. State of the department - Nick Abbott (Capitol Club, Hilton)

Monday, April 26, 2010

- 7:00 A.M. - 8:00 A.M. Visiting Committee executive meeting & breakfast (Olive Alcove, 1st floor, Hilton)
- 8:00 A.M. - 8:30 A.M. Travel time to Engineering Hall
- 8:30 A.M. - 8:45 A.M. Meeting overview - Nick Abbott (Room 3609 EH)
- 8:45 A.M. - 9:45 A.M. Department Vignettes (Room 3609 EH)
- UG curriculum - new class on computational tools and modeling
 - UG laboratories - enrollments and opportunities
 - Centers (MRSEC and NSEC) - impact on department
 - Alumni interaction - launching of the "Wisconsin Connection"
- 9:45 A.M. - 10:00 A.M. Break
- 10:00 A.M. - 11:00 A.M. Presentation and Discussion of Strategic Plan (Room 3609 EH)
- Drivers of change in discipline and department
 - Mission and vision of the future of our department
 - Goals: Undergraduate and graduate programs
 - Goals: Research leadership
 - Goals: Faculty environment and physical infrastructure
 - Summary
- 11:00 A.M. - 11:30 A.M. Visiting Committee executive session (Room 3609 EH)
- 11:30 A.M. - Noon Discussion and feedback on strategic plan (Room 3609 EH)

Noon - 1:00 P.M.	Catered lunch with faculty (Cheney Room)
1:00 P.M. - 1:30 P.M.	Concurrent subcommittee meetings <ul style="list-style-type: none"> • Discussions with undergraduate students (Room 3239 EH) • Discussions with graduate students (Room 2024 EH) • Discussions with junior faculty (Room 3609 EH)
1:30 P.M. - 2:30 P.M.	Visiting Committee executive session (Room 3609 EH)
2:30 P.M. - 2:45 P.M.	Break
2:45 P.M. - 3:30 P.M.	Presentation of draft report and discussion (Room 3609 EH)
3:30 P.M. - 4:00 P.M.	Meet with Dean Paul Percy (Room 3609 EH)
4:00 P.M.	Adjourn