**2013 External Program Review Report for the Botany Department, Weber State University**

Submitted 1 April 2013 by the External Review Team
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Our review team members individually reviewed the Self Study provided in advance by Dr. Barbara Wachoki, Chair of the Botany Department. The site visit took place on 28 March 2013 and all team members were present throughout the visit. In addition we were provided additional information (some on request) that included Curriculum Vitae of all the faculty, detailed information on the degree programs offered in Botany (tracks, options, enrollments), course descriptions, recent enrollment numbers for all courses taught, and detailed portfolio information. We also reviewed portfolios and course exams during our visit. We participated in extensive and informative visits with the dean, the faculty and staff, and the students. We were highly impressed with the Department and campus, and were privileged to have participated in this review.

## Strengths

*Faculty*: The Botany Department is composed of dedicated and caring faculty engaged with their students in the classroom and involved in many scholarly extracurricular activities with them. It is clear that they inspire students about plants and their place in the world, and provide expertise to future policy makers and the public. The expertise of the faculty members is broad, ranging from taxonomy and ecology to molecular biology. They have developed a strong niche for their students in providing excellent training in field specialties and skills, an area in demand by federal and state agencies. Faculty have cultivated productive relationships in several regional networks that help place students in internships and permanent jobs. For example faculty (and students) are involved in work with Ogden community gardens, Native American tribes in Utah, federal and state agencies, and public school systems. The Department should be commended for recruiting a rising number of majors in the program at a time when Botany is taking a hit across the Nation.

*Curriculum*: The Botany Department offers a traditional curriculum that includes several options and tracks within its degree programs. The curriculum offerings meet (or could easily meet) federal requirements for Botanist positions and for national certifications by the Ecological Society of America and the Wildlife Society. The courses offered provide both breadth and depth to the curriculum with many opportunities for independent research embedded within them. Class sizes are small providing excellent opportunities for student-faculty interaction and student-student interaction. The outcomes and assessment information provided evidence of students acquiring knowledge, skills, and values.

*Undergraduate Research*: Students receive intensive research mentoring and frequently attend NCUR and other professional meetings to present their research. They voiced sincere appreciation that grant writing has been part of their training as undergraduates. Research is also embedded in Botany courses, although we did not see syllabi to determine if this occurs in all

courses in the major, but we got the impression from the students that this frequently is the case. The students were particularly complimentary of Dr. Deckert's inquiry driven course in plant morphology and anatomy.

*Student Satisfaction*: The students we met with are highly satisfied with their learning experiences, and appear to be well trained. By all appearances they are well advised by the Chair and faculty, and are receiving a high quality education with the hallmark of independent research experiences, theses, portfolio development, and successful job and graduate school placement. The students praised the Botany faculty for their willingness to mentor them, their enthusiasm for the students and the discipline, their approachability and dedication, and their high level of knowledge in the classroom. The students with whom we met were inspired and well prepared for their career goals.

*Staff*: The new lab director/greenhouse supervisor, Sonja Welsh, is a strong asset to the Department. She exudes enthusiasm and is very knowledgeable. She is personable and works well with the students and faculty. She is an excellent addition to the Department, and her work is strongly complimentary to that of the faculty. She is exactly the right type of person to interface between the faculty and students.

*Administrative Leadership*: At the outset of the site visit, Dean David Matty stated that he did not have an agenda to consolidate the life science departments at WSU but was seeking input into how to improve the department, help it move forward, improve its efficiencies to enable the faculty to have more time for research and excellent and innovative teaching, and to broaden the students' training. By all accounts, he appears willing to work with the Botany Department to free up more time for research and mentoring by providing buyouts and adjuncts to accomplish this. Additionally, he has recent National Science Foundation experience, and with his input into proposals this could provide a competitive edge to these faculty. When we raised the faculty's concerns with regards to sharing teaching of conceptual biology courses (such as Biology, Genetics, Ecology, Cell Biology) and developing an integrated curriculum, he stated his willingness to negotiate equitable credit for any cross-listed and team-taught courses, and to formalize those agreements in writing so that the Botany Department is not disadvantaged.

**Challenges**

*Number of faculty:* The Botany faculty is far too small as a consequence of two recent retirements and this has repercussions for all aspects of the department. In an effort to piece together all of the courses historically offered when the department was fully staffed, faculty are overworked. They are taking on additional courses in overload (online, evening, summer) which leaves little time to do much else, such as proposal writing, research, or developing additional innovative courses and teaching. Part of the motivation for teaching an overload is a sincere concern for students (the need to provide a complete curriculum and small classes) but there is also a fear of losing SCHs, which could negatively impact the department. The Botany Department should have a minimum of six faculty members to have a critical mass to meet their teaching and mentoring demands. The department should consider streamlining the curriculum by identifying those courses that are required for a core program in Botany, and how best to

deploy faculty among those courses as a first priority. For example, while current faculty acknowledged that they will lose marine biology in their curriculum when Dr. Bozniak fully retires, there also was repeated discussion of needing to offer previously taught courses, such as Soils and Garden Plants. These courses could be covered by adjunct faculty or discontinued, with the new hires (core faculty) more appropriately focused on offering new courses in their areas of expertise.

*Faculty demography:* The demographics of the faculty are best described as mid and senior career. Faculty poised for retirement are not taking it because they fear that the department will lose the positions. Thus, the Department needs assurance that when faculty members retire, they will be replaced. Otherwise the Department is not in a position to move forward.

*Clarity/transparency of administrative expectations and metrics:* The Botany Department is uncertain of, or lacks confidence in the consistent application of, the metrics that are used by the administration for evaluation. The importance that the university places on student credit hour production, versus number of majors, versus number of graduates is not clear and this impedes strategic decision making in the department.

*Integration of Botany with other life sciences departments on campus:* The Botany Department faculty appear to have little interaction with other life sciences departments on campus. The review team saw little evidence of team teaching, co-led student projects, or joint seminars. There was a sense of reluctance among some faculty when discussing teaching and research collaborations or doing things differently than in the past. Part of this reluctance stems from the lack of clear assurances from the administration about how credit hours for team taught courses would be allocated, and part from a fear that Botany would not be well represented in team efforts, or that other departments were not willing to collaborate. Isolation, however, is no longer a viable mode for higher education. All universities are thinking much more strategically than in years' past, and the Botany Department could look to examples from other universities for models of integrated teaching that would be supported by the college and be viable in collaboration with the other life sciences departments. They could easily be involved in team-teaching general biology courses, and integrated genetics, ecology, and cell biology courses. By team-teaching (not turn teaching), they could ensure that the topics are well covered and integrated, and this would maintain high pedagogical standards. Formation of team taught courses would require a change by all three life science departments to share and co-teach these types of courses, including credit. This could be an excellent opportunity to grow the Botany major by the Botany faculty having direct access to all life science majors rather than recruiting out of non-majors and General Education courses.

Once the basics have been covered in team taught courses, Botany faculty could teach plant specific concepts in specialty courses, targeted readings, or independent studies. Small enrollment courses could be taught as collaborative independent study courses.

Development of a more integrated curriculum will likely require incentives and clear guidance from the dean's office so that there are clear advantages and low risks for faculty members.

*Curriculum development, student training, and student recruitment:* As noted above, the curriculum could be streamlined to reduce the workload of current faculty and to facilitate more cross-disciplinary training.

The Botany faculty have developed a degree option in natural medicine and feel they can send their graduates to natural medical schools. None of the review team members have this type of expertise or professional insight into this approach so it is difficult to provide input on this. The Botany faculty may be correct that this is an opportunity to tap into the pre-med majors. However, they should do extensive research into this area to determine how many natural medicine programs exist, how many students are recruited into these programs, and the strengths of their recruits. They should establish the Botany program as a pipeline to the natural medicine programs.

The forensic botany lab established by the department should be successful with students, especially in light of so many popular television shows such as CSI and could be a great recruiting tool. Botany faculty could investigate other forensics programs in the U.S. to get a better understanding into how their program might interface with graduate or professional programs in this area.

The Botany Department could also work with Education to recruit students who intend to become biology teachers. The department apparently shares a secondary education teacher preparation track with the zoologists but the review team is uncertain how many students are recruited into Botany via this track.

Advising is very strong in the Botany Department but the responsibility appears to fall solely on the Chair. Addition of faculty would allow the department to redistribute this responsibility. They should consider designating a faculty internship coordinator and including this type of information on their website.

Botany students would benefit greatly from attending more professional conferences beyond NCUR to network and learn about research within the discipline. Most professional societies offer travel grants to help defray costs for students, and there are often activities at the meetings targeted specifically at students. The Botany Club is a thriving student organization at Weber State that sponsors field trips and scholarships. We were pleased to hear that the Botany Department recently applied for a Botanical Society of America student chapter designation. The Faculty should look into establishing a Sigma Xi (all sciences) student chapter, and an honor society such as Tri Beta (all biological sciences) if that is not already on campus. Both of these would foster interdepartmental cooperation.

As stated in the Self-Study, the Botany Department needs more marketing and recruiting assistance. Minimally they should develop a brochure and mail (or email) it broadly. While the Botany faculty voiced the desire to recruit out of state, they could do some recruiting locally in high schools to raise the awareness of botany.

*Professional development for faculty:* While the Botany faculty were much more research active in the past, as their Self Study points out, this has waned in recent years. Undoubtedly this is due

to their aging demographic and their overload work ethic as it applies to teaching. The faculty need support and encouragement to establish new collaborators since their previous ones have retired, and start pursuing NSF ROA and RUI types of grants. They need incentives to conduct research in the summers rather than teaching if that can be managed. And they need new faculty hires to reenergize the scholarly effort in the Department. The faculty should also be encouraged (via financial support if possible) to attend meetings of professional societies. Such meetings are critical for keeping up with research developments and networking with colleagues. Most of the major professional societies have very active teaching sections and provide excellent opportunities to learn about teaching innovation and best practices.

*Strategic planning:* The review team was not made privy to a strategic plan. It is recommended that the Botany Department develop a well-articulated strategic plan, with particular emphasis on rationale for future hires. Development of the strategic plan may benefit from an outside moderator who is current on trends in plant sciences.

The Botany faculty have discussed future hires, however, these appear to the review team to be somewhat vaguely defined. The faculty should investigate specific areas for future hires that would both complement their strengths and add to their teaching and training capacity. What fields are most in demand by potential employers? What fields are growing and receiving grant funding? What fields will provide the types of skills that students should be exposed to? The Botany faculty are advocating for an ethnobotanist but need to define this beyond the traditional sense to hire a modern biologist who complements their current expertise. The review team is skeptical that ethnobotany would be the best choice for student training, but none of us has expertise in this area. The Botany faculty also have identified a need in the area of ecosystem monitoring, which would complement their strengths in field botany. The department might also consider such fields as genomics, bioinformatics, and development.

*Staff Support:* The Botany Department has only a half-time, 10-month Administrative Assistant and this places additional burdens on the faculty to do clerical work. It seems counter-productive for the faculty to spend their time doing clerical work. If it is not possible to increase the office staff hours, support from other offices across campus should be provided.

*Facilities:* Much of the review team's comments about facilities will be made moot by the news that funding for a new science building has been approved. The herbarium, a collection of ~10,000 specimens of plant species that occur in the area, is a nice facility that is well-curated. It serves in training students in plant identification and traditional taxonomy. The greenhouse is a nice addition to classroom teaching that helps students learn about plant form and function, growth, diversity, and experimentation. The faculty should consider how they can most efficiently use space in the new building, and how share to share space and equipment where it is beneficial to all three departments, including classrooms and research labs. They also need to consider not only the greenhouse and herbarium space in their overall planning, but also display space to promote plant biology in an area like the museum or even a small conservatory with live plants. And while the Botany operating budget is small, the Department manages to purchase the equipment and supplies necessary for their courses of which some have fees.

**Opportunities**
The department's portfolio assessment tool had great potential for providing useful information to evaluate how well they accomplish their mission in the context of the college and university (Standard A, part b). Although primarily intended for the students, a rubric could be developed to gather necessary information from students' portfolios.

The greatest number of opportunities for the department falls within Standard B – Curriculum. This is an ideal time for the three life-science departments to join efforts in developing a common, major concept-based, introductory course. The AAAS Vision and Change document http://visionandchange.org/files/2011/03/Revised-Vision-and-Change-Final-Report.pdf and the Introductory Biology Project website, http://ibp.ou.edu/ provide a wealth of models and tools to accomplish this task. Ideally this should be a team-taught course, drawing on the resources of all three departments, and each department should be equitably credited. The departments should also consider increasing the size of the class (to decrease number of sections), but incorporate some of the tools that have been demonstrated to be useful in large classes, such as peer learning, clickers, "flipped" classrooms, etc. (see for instance: Armbruster et al. 2009, CBE-Life Sciences Education 9:203-213 and Freeman at al., CBE-Life Sciences Education 10:175-196.).

The consensus model introductory biology course now focuses on four big ideas: Cell/Molecular Biology, Genetics, Ecology and Evolution. Three of these are duplicated in upper-level discipline-specific courses. The departments may want to consider expanding a common introductory course to two semesters allowing each of these areas to be covered in enough depth to provide the necessary foundation for upper division disciplinary-based courses. Ideally this should be a team-taught course, drawing on the resources of all three departments, and each department should be equitably credited.

The department should explore further collaborations with other departments so that students receive exposure and training in some of the more recent technologies and quantitative applications. There is already some collaboration in GIS and electron microscopy, but biotechnology in general and genomics and bioinformatics in particular would be a great benefit to students.

The current program tracks are very traditional, although the core is not identical for all. There are also a large number of elective courses. Assessment of the overall curriculum and individual upper level courses has not yet begun, but this will help the department determine whether the core can be streamlined and if changes should be made in additional required courses. Assessment information and enrollment trends will also help the department prioritize the importance of individual elective courses to provide the best learning opportunities for the most students. With the potential for hiring new faculty members, an objective curriculum review will highlight the areas with greatest need for new expertise. The department already has identified a track in natural medicine that, as opposed to the traditional fields of economic botany or ethnobotany, could be a significant asset for the university, particularly within the state and region. This track could have the potential of tying together traditional taxonomic and natural history strengths with modern molecular approaches.

The department also has several opportunities to develop in relation to Standard C – Student learning and assessment. There are a growing number of validated content inventories in the biological sciences that could be used to directly measure improvement in student understanding of core concepts: see http://www.sci.sdsu.edu/CRMSE/files/Concept_Inventories_in_Biology_20110325.pdf In addition, a validated inventory of general science literacy skills has recently been published, http://www.lifescied.org/content/11/4/364.full.pdf+html. These would provide much more meaningful information about student learning than a matrix of traditional exam questions and learning outcomes. Student portfolios also appear to have great potential as an instrument for faculty to assess student learning over the course of their college experience. This would require developing a rubric to gather information from what is primarily a student's self-assessment.

As mentioned above, two open faculty lines provide a tremendous opportunity for the department to build on the faculty strengths already present. The faculty should carefully consider what areas are growing, both student wise and career wise, and what areas would best suit the stakeholders of the surrounding community from which most students are recruited. The opportunity to add dedicated new faculty members who are passionate about botany and teaching will alleviate what are currently the greatest weakness of the department, faculty size and workload, Standard E.

In terms of program support, Standard F, a significant opportunity could be found in the Natural History Museum. This wonderful facility highlights the sciences for students and visitors, but the exhibits are mostly zoological or geological. The faculty could work with students to create engaging displays on topics such as: medicinal plants, traditional ecological knowledge, paleobotany or forensic botany. The Botany Club could provide many interesting ideas or even take the lead on this project. The Department should consider featuring a student or an alumnus each week or month on the website to highlight their research projects as a way to bring attention to the individual opportunities provided.

Finally, there are several opportunities to relate to the external community, Standard G, that would build on current strengths of the department. Further outreach to tribal communities and interactions with the local schools could provide opportunities to recruit new students into the program. Interactions with the Education Department may be useful for attracting additional teachers to STEM fields, but particularly with a plant focus. Plans are already underway for creating both a General Advisory Committee for the department, composed of alumni and community members, and a specific Employer Advisory Committee. These are excellent ideas with great potential for growing the department.

**Threats**

There is a grave threat to the Department of Botany if it isn't allowed to replace retired and retiring faculty in a timely manner. The Department is too small to buffer the impacts to students and to the curriculum when one-third of the faculty have retired and have not been replaced. They also are facing additional retirements in the near future that need to be considered. Furthermore it is important to maintain a healthy demographic that includes faculty at all ranks

so that there is a high level of energy in the department coupled with experience. The Botany Department faculty are unable to maintain any level of research or professional development when they are so busy teaching overload courses in their efforts to maintain their course offerings and total number of student credit hours.

It should be mentioned that the Botany faculty consider consolidation into a biology department to be a threat. When Botany programs are lost, plant scientists are always in the minority and don't have equal voting power when new searches are approved and curricula developed. Over time they lose courses and faculty, and with that go the students. It is imperative that the Botany Department and its Faculty not be disadvantaged by an integrated curriculum with safeguards developed at the outset.

Along these lines, the lack of a clear set of metrics for evaluating the cost and benefits of making program adjustments, developing new specialty areas, and bring on new faculty is an overarching threat. It reinforces the status quo, which is in the near and intermediate term, increasingly unviable. Alternatives to the current conditions cannot easily be judged, thwarting the continuing development and evolution of the department.

**Summary**

The Botany Department is a highly functioning department. They have a unique identity and niche in Utah and the region, and an excellent reputation in student preparation into field types of careers. They hold a high level of collegiality, enthusiasm, and dedication – all of which should be rewarded and nourished. They are incredibly passionate about plants and students, and have built an enviable Botany program as a result of their strong work ethics. We highly recommended that the Botany faculty number be minimally maintained with six faculty so that the curriculum can be modernized, integrated, and further energized. In addition, the faculty need to be incentivized, supported, and rewarded to pursue more scholarly and grant-writing activities to support student development and other initiatives. Lastly, the Botany Department faculty and staff need a clearer environment for evaluating decisions about the future of the department.