

WCU BIOLOGY PROGRAM EXTERNAL REVIEW REPORT, SPRING 2016

External Review Team

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I. INTRODUCTION

Description of visit length and summary and description of meetings conducted by the review team

The site review team spent two days (3/14/16-3/15/16) visiting with various groups of Biology Department faculty, students and WCU administrators in order to evaluate the undergraduate and graduate programs in the Biology Department, identify strengths and weaknesses in the programs and the resources that support those programs, and make recommendations regarding program needs. Meetings included: (1) informal discussions with the Provost and Associate Provost on the academic environment at WCU, in general, as well as perspectives on the Biology Programs; (2) more focused meetings with the Deans of the College of Arts and Sciences and the Graduate School; (3) a tour of Department facilities and walking discussion with the Biology Department Head and Assistant Department Head; (4) separate informal discussions with faculty, selected students, and untenured and fixed term faculty; a follow-up discussion with the Biology Department Head and Assistant Department Head; and (5) debriefing meetings with administrators. These meetings, in combination with written materials prepared by the department, provided the review team with a broad overview of the Department and its programs.

II. ANALYSIS OF PROGRAM

a. Undergraduate program

i. The curriculum (Is it appropriate for WCU's student body? Can students make adequate progress to degree? Are the prerequisites/required courses appropriate to the curriculum?);

Overall, the biology program at Western Carolina University is academically rigorous and is meeting the needs of student majors. The curriculum is comprehensive, with appropriate lower and upper level core courses and an assortment of electives reflecting subdisciplines within the major. Many of the upper level course offerings mirror faculty disciplines and expertise. The program provides evidence that it has a robust mission statement and is well aligned with the University's strategic plans. The biology program supports the QEP and intentionally integrates learning outcomes into the curriculum as appropriate. These expected learning outcomes are clearly stated on course syllabi. Four concentrations, including general biology, molecular biology, pre-health professions, and ecology and evolutionary biology provide a framework for students to tailor their core and elective courses to serve their intended career paths. Concentration options are clearly articulated in the catalog, providing a useful advising tool. These options are consistent with approaches used by other successful

undergraduate biology programs. In discussions with the review panel, several areas were identified that may require attention relative to the biology curriculum.

1. Departmental growth and areas of student interest

The biology department, with an estimated 480 student majors, is one of the largest programs at WCU. While growth has slowed somewhat recently, the department went through a very rapid increase and is still continuing to grow. The increase in student numbers has created two main issues with regard to the curriculum. The first is that a majority of students are now interested in careers in the health or biomedical professions, which require a strong background in areas related to cell and molecular biology. Since there are fewer faculty with backgrounds in cell and molecular biology, there are fewer opportunities for upper level electives or research and mentorship in this area. It is clear that the department understands this and is working towards hiring additional faculty with cell and molecular expertise, which is to be commended. It also recognizes that hiring these additional faculty will require resources of a different nature than hiring faculty with environmental biology backgrounds. It should also be noted that the use of cell and molecular techniques applied to field based projects is also likely to increase, and may be a particular future strength of the WCU Biology program. A related issue is that the cell and molecular biology course is not actually a required course in the core. Most students end up taking it, but it may be worthwhile to add this course to the required core if it can be done in a way that does not slow time to degree completion.

2. Capstone research requirement

A second curricular area impacted by student growth is the capstone research requirement. The department articulates a capstone research experience as a key component of its curriculum. On the one hand, this is an extraordinary opportunity for students and is the type of student experience that sets WCU apart from larger universities in the system. On the other hand, this type of experience is difficult to sustain given the faculty/student ratio and high numbers of fixed term and adjunct faculty who may not contribute regularly toward undergraduate research opportunities. The review panel saw evidence that WCU students are currently involved in impressive research projects. However, the ability of the faculty to deliver individual and personally tailored research experiences to all students is not sustainable given student growth. This is especially true in the area of cell and molecular biology, where most student interest is focused, and there are fewer faculty. To address this, the faculty has already developed additional approaches, including capstone experiences that may include group work in either a laboratory or seminar style, and other discipline appropriate experiences. High impact alternatives include early research experiences such as the HHMI phage hunters course; national assessment shows that early experiences result in earlier development of research and problem-solving skills, positive interactions with faculty, and persistence of acquired knowledge and skills, resulting increased retention and higher outcomes overall. Authentic undergraduate research experiences are highly valuable for WCU students and should be supported, regardless of their location in the curriculum structure.

3. Differentiation of concentrations

The four biology degree concentrations, including general biology, molecular biology, pre-health professions, and ecology and evolutionary biology, have very little that differentiates them from one another. The existence of these concentrations is recognized as a marketing approach to draw majors, but it appears that all majors, regardless of the concentration, have sufficient curriculum choices to

design a personalized program based on individual interests and needs. Accordingly, the four concentrations could be streamlined into a smaller number of concentrations, with less overlap in elective courses.

4. Curriculum review

It appears that a systematic and strategic curriculum review has not been formally conducted for some time. Given the increase in majors and SCH generation, a curricular review should also consider additional pedagogical approaches that provide additional discovery-based exercises earlier in the curriculum. There is evidence of these approaches in the department. However a formal and thoughtful discussion about future approaches to high impact pedagogies, streamlining the core and providing more focus in the concentrations, while maintaining attention toward developing science writing skills, is warranted and should be developed and owned by the Biology faculty.

ii. The student body (Is the faculty/student ratio appropriate? Is the student body representative of the region, mission, goals/objectives of the program?)

The student body appears to be representative of the region, mission, and goals of the program. However, the composition of the student body has grown rapidly and changed toward more interest in cell and molecular biology, whereas the expertise of the faculty is more heavily focused on ecology. There is a pressing need to hire more faculty in the area of cell and molecular biology and to return resources to the department commensurate with the production of student contact hours. In addition, it is very clear that additional new classroom and laboratory space is needed to accommodate the growth that has already occurred. Future growth will severely stress the existing space available. Despite this, the students we met with were very positive about their experiences with the faculty and the biology program as a whole. Discussions with students, in combination with evaluation of the curriculum, suggested that core competencies are being met overall. However, we were less able to evaluate the extent to which the modeling and simulation competency is being met; some students stated that they were exposed to the concepts, but with very little depth.

It appears that transfer students arriving in the spring semester may have lower entrance metrics than the fall classes, as evidenced by a drop in mean SAT scores. These students may require additional resources (e.g., peer tutoring, peer mentoring, faculty interaction, etc.) to be successful at the University and in the Biology Department.

iii. Planning and assessment strategies (Can the program document student learning? Are the goals/outcomes appropriate? Do all faculty have an opportunity to participate in planning and assessment activities?)

The most recent (2014-2015) annual assessment report for the BS in Biology relies upon collecting enrollment numbers, GPAs, and final course grades for students enrolled in four core courses in the program [BIOL 140 (Principles of Biology I), BIOL 141 (Principles of Biology II), BIOL 240 (Introduction to Genetics), and BIOL 241 (Introduction to Ecology and Evolution)] and comparing final course grades of Biology majors to non-majors in those classes. Some prior year's reports (2013-2014 for example) analyze percentage of correct answers to selected exam questions that reflect specific program outcomes. The results of the 2013-2014 analysis were inconclusive, with the program stating it would "work to produce a more meaningful assessment tool for use in the coming years," but the 2014-

2015 report appears to collect fewer data and yield less useful information (other than reflecting the growing numbers in those classes). During the on-site review, the review team met with the Department Head and program directors and asked specifically about assessment being conducted in the department. The Department Head noted that he was collecting information from sources in addition to the aforementioned numeric metrics, including exit interviews with students, which the review team viewed favorably.

In the area of ongoing planning the department thought it might be time to consider revisions to the curriculum. The program's self-study notes that "the QEP is a primary planning tool for the Biology undergraduate curriculum," and that the QEP assessments of 2014 and 2012 "prompted us to change our approach to particular classes." The Head and Assistant Head stated that they thought it would be a good idea to move forward with a formal curriculum review, a plan that the review team found to be timely. Such a formal curriculum review should be in the context of: 1) progress since the 2020 plan was implemented (some goals have been met, but are still on their matrix); 2) the changing face of the Biology major (pre-professional/molecular focused); 3) the value of including research/experiential methods early in the curriculum; and 4) planning for the new building (including classroom/lab design), a curriculum review and plan may be helpful to forecast needs.

Since annual program assessment focuses upon stated programmatic learning outcomes and the curriculum which is associated with those learning outcomes, it is important that the program consider making its annual program assessment more meaningful and robust. Given the current workload in the department, it is important to ensure that the approach to collection and interpretation of assessment data not become overly onerous. Grades do not provide particularly good assessment of student outcomes, especially if they are collected as the only metric. Assessing responses on specific exam questions can be useful, especially if such entry-level or gateway data is paired with end-of-program data such as exit interviews, assessment of selected works in the final year of the program, and/or alumni surveys. Rather than attempting to assess every program outcome each and every year, the program might consider collecting data to assess one or two outcomes a year on a rolling basis. Regardless of the methodology the program implements, it should detail that process in an updated program assessment plan and it should clearly document how those data have led to curricular and programmatic changes; such documentation is required both by WCU and by its accreditor (SACS).

While the undergraduate Biology program is clearly invested in and involved with college- and university-level planning and assessment, a systematic approach to program-level planning and assessment that leads to meaningful and data-driven changes appears somewhat haphazard and intermittent. The department is encouraged to consider ways to implement regular and ongoing planning with respect to its programs, faculty mix, and curriculum, and in particular to consider ways in which the required annual program assessment might be integrated more meaningfully into that long-term planning. The planned curriculum review is a step in the right direction, but unit-level planning entails more than curriculum. The department might consider initiating a strategic planning committee, or devoting certain faculty meetings each year to program planning. Whatever the program decides to implement, it should ensure that a broad spectrum of its faculty (and possibly students and alumni) are provided opportunity for input. This process could be initiated in tandem with the ongoing planning of the new Science Building as it is expected that the physical layout of the laboratories and classrooms will be designed largely to meet student and faculty needs.

b. Graduate program

i. the curriculum (Is it appropriate given faculty interests/qualifications? Is the focus well-defined and appropriate to the mission of the program and needs of the discipline? Are the prerequisites/required courses appropriate to the curriculum? Is it of sufficient academic rigor?)

The WCU Biology MS program is a rigorous thesis-based graduate program. The majority of students entering the program pursue ecological research, consistent with the research focus and qualifications of the majority of the faculty. The graduate curriculum has a minimal structure, i.e., no program core courses, which is common for MS Biology programs; some programs have no formal course requirements all. The only specific requirements in the WCU MS curriculum include 30 credit hours of graduate work distributed as: (1) six thesis credits taken after the thesis proposal has been approved; (2) three credits of graduate seminar enrollment as 1 credit in each of three semesters; and (3) remaining credits selected from electives under the guidance of the student's advisor. Elective courses often include graduate offerings in related fields outside of the department. In this way, the curriculum is flexible, potentially interdisciplinary, and highly tailored to the individual needs of the student, and consistent with the departmental mission to encourage learning, critical thinking, and scholarship in biology. Students have the option of including coursework taken during the summer at Highland Biological Station. Among the elective credits in the graduate program, students may enroll in research credits, with the requirement that the research conducted is unrelated to the student's thesis work. Academic rigor in this flexible curriculum is ensured by the requirement that students pass a comprehensive exam prior to their second year of the program.

The general conceptual basis for a lack of core courses in many Biology MS programs is that the overall program goal of the MS degree in Biology often is to encourage learning and provide training in original research relevant to the discipline. Courses that students take are designed to provide a deeper subject matter understanding and training in specific skills that are relevant to enriching the thesis research. Such coursework needs vary widely with individual students. Accordingly, a question for the WCU Biology faculty to consider is, to what extent do the remaining 21 elective credits required for students to meet the 30 credit minimum need to be derived from formal courses? Students entering the program with a strong background might be better served with fewer formal courses, and more emphasis on research. Might some of the credits needed to fulfill a 30 credit graduate degree minimum be derived from research credits related to the thesis topic prior to approval of the proposal? The UNCG Biology MS program illustrates an example of this model. Students are also required to register for 6 thesis credits (Bio 699) after acceptance of their research proposal, and are advised into appropriate courses for their individual needs that are typically completed before or during the same semester as the thesis proposal is defended. However, prior to acceptance of the proposal they may also register for up to 9 credits of graduate research (Bio 695) permitting them to begin preliminary research in preparation for their proposal and thesis. This approach provides flexibility for students who enter the program with a strong background and therefore have less need for formal disciplinary courses.

MS Biology students complete the rigorous program in approximately 3 years on average although some finish in 2 years (Appendix 8 of Departmental documents). Although Biology MS programs are generally designed as 2-year programs, it is very common for MS students in similar programs to need 3 years to finish their degree. Thus, time to degree in the WCU Biology MS program is similar to MS programs elsewhere in the UNC system. This is commendable given that the level of financial support provided to these students is low compared to other Biology MS programs in the system.

In any evaluation of the rigor of an MS degree program, it is important to consider the fate of students who complete the program. It is commendable that most of the students who have completed the program since 2012 are either professionally employed as biologists or enrolled in Ph. D. programs elsewhere (Appendix Standard 5.7). Tracking data are likely less complete for earlier years, but those data also show that students completing the Biology MS program at WCU have entered fields appropriate to their MS training.

ii. the student body (Are the qualifications and mix of students appropriate to the program? Is the student body representative of the region, mission, goals/objectives of the program? Does the program offer adequate support for students admitted to the program?)

To be admitted to the Biology MS program, a prospective student must hold an undergraduate degree in biology or related field and have completed the equivalent of the undergraduate core requirements in the Biology Department. Accordingly, WCU Biology MS students are generally well qualified for MS work. As noted above, most of these students focus on organismal, ecological and/or evolutionary biology questions for their research, consistent with the research interests of a majority of the faculty. This focus is also appropriate for the regional setting of WCU in a recognized global center of biodiversity. The setting also offers many outdoor recreational opportunities that tend to attract students interested in ecology

Financial support for the MS students is generally poor, and this is an area that needs a more creative approach. The site review team did not see quantitative data on the proportion of students supported overall, but we were told that many students do not receive assistantships, and a very, very few receive tuition waivers. Furthermore, the size of most assistantships, \$12,500 per academic year, is low compared to most Biology MS programs. Some students have additional support in the summer through summer TAs or research grants, and an occasional student may be supported on research assistantships during the academic year. The problem of tuition waivers is a system-wide program and very difficult to solve. However, it may be possible to administratively reduce the problem of insufficient teaching assistantships. One possibility is that graduate students could be supported by greater integration into introductory and service laboratory courses. It wasn't clear how many of those laboratory sections were being taught by faculty, or whether those faculty were tenure line, fixed term, or adjunct. However, to the extent that adjunct faculty are hired to fill teaching sections that could be taught by graduate students if more graduate teaching assistantships were available, resources could be redirected from hiring adjuncts to supporting more graduate students. Such an approach requires more advanced budgeting than hiring temporary faculty, but the outcome would be financially more efficient and would enhance the graduate program.

Regardless of the number of graduate students supported by teaching assistantships, a structured approach to pedagogical training of graduate teaching assistants is important to make sure that the quality of undergraduate instruction remains high.

iii. Planing and assessment strategies (Can the program document student learning? Are the goals/outcomes appropriate? Do all faculty have an opportunity to participate in planning and assessment activities?)

The annual assessment of the Biology MS program relies upon a rubric-driven evaluation of the Oral Defense and of the MS Thesis. Six program outcomes are scored on a three-point scale (from Needs Improvement to Exceeds expectations) and those scores are reported by frequency. Recent annual assessment reports contain the results of that data collection but no discussion of results or of any programmatic changes that derive from such results.

In many ways, the status of the MS Biology program's ongoing planning and assessment mirrors the status of the undergraduate BS Biology program (see II.a.iii). The annual program assessment reports provide data from appropriate and meaningful sources (Thesis and Oral Defense) but there is no indication of programmatic changes that derive from such assessment or of how the data collected are being interpreted. Graduate faculty in the department appear to be invested in the students and in the program, and generally possess a common understanding of strengths, weaknesses, and issues in the MS Program, but there is little indication of systematic program planning at the graduate level or of

programmatic changes affected by assessment. As with the undergraduate program, the MS Biology program should consider ways to better tie assessment of outcomes to planning that allow for input from graduate faculty in the various sub disciplines and, possibly, from current graduate students, alumni, and/or key partners (such as government agencies where their graduates often find employment). At a basic level, it is important for the program to be asking how it knows whether students are achieving programmatic (not merely course-specific) outcomes and what it might plan to do in the future to facilitate student success vis-à-vis those outcomes.

III. Analysis of Faculty

a. Qualifications

The program faculty are highly qualified with appropriate credentials for the discipline. The tenured/tenure track faculty provide strong evidence that they are actively engaged in teaching, scholarship, graduate student mentoring and service. A hallmark of academic relevance is the successful acquisition of external funding. The program provides good evidence of recent and on-going extramural funding from state and national agencies (e.g., North Carolina Biotechnology Center, USDA, NSF, Howard Hughes Medical Institute, and others). Similarly, fixed-term faculty are also highly qualified and are active in scholarship and service, including participation as graduate student committee members, in addition to their teaching obligations.

b. Resources and Support

The Biology faculty have excelled in spite of difficult fiscal times for the institution, in part due to the commitment of Biology faculty to student and institutional success, broad-based support at WCU for Biology classes and programs, and adept leadership. There are ample funding resources available throughout the University for faculty scholarship, travel, and professional development. There are competitive intramural funding opportunities at both the College and University level and the Biology faculty provide evidence of obtaining these funds on a regular basis. Resources to support travel to academic meetings are also available including the Chancellor's Travel Fund (up to \$1,200 annually). Likewise, there are professional development grants available through the Coulter Faculty Center. The Department stated that the library resources are adequate to support their mission and goals in spite of budget cuts that threaten important research databases and journal packages.

However, the review team identified a number of resource and support areas that have the ability to positively affect faculty success significantly:

1. New faculty support

The Rank, Tenure, and Promotion guidelines described in the Department's Collegial Review Document are adequate and appropriate for the WCU Biology Department. The faculty describe these guidelines as fair and attainable.

However, there is a recent history of failed tenure attempts among faculty in cellular/molecular disciplines. Based on interviews with the Dean and Department Head, these examples are not likely associated with a lack of institutional or departmental support. However, the review team is concerned that the current tenure-track cell/molecular faculty, and potentially future hires, although less at risk of failing the tenure process, are at risk for "burn out" post-tenure due to a few addressable factors.

a. Research mentoring of undergraduate students. Traditional “one-on-one” mentorship in a laboratory with undergraduate students may be a “high risk/low return” research endeavor for new faculty. These faculty are often arriving directly from research-intensive universities with large instrument core facilities, “deep” laboratory hierarchies, and a large cadre of faculty and postdoctoral peers within the discipline that can provide technical and other support not readily available at WCU. Because undergraduate research is highly valued as a High Impact Practice and aligns with the University’s Intentional Learning Plan (i.e., QEP), a new faculty member may be torn between student engagement and the requirement to be productive (i.e., publish and seek external funding) in an environment that is inherently challenging and different from their previous experiences. Thus, new faculty need appropriate mentorship and guidance in order to develop a “right sized” research program that is productive and sustainable with the resources available at a predominately undergraduate institution. This mentorship should be formalized with goals that are measurable and realistic. Ideally both the mentor and mentee should develop goals that are integrated into the Annual Faculty Evaluation so that both are accountable. It is important that the mentors are themselves successful faculty who have a track record of research productivity in the area of cell and molecular biology in a primarily undergraduate environment. It may be useful to also look outside of WCU for such faculty mentors.

b. Administration of start-up funds. In addition, a more thoughtful and flexible approach to start-up funds is required for cell/molecular faculty. A new faculty member must balance the first year demands of teaching, the discovery of institutional norms and resources, and must thoughtfully develop a sustainable research program with WCU students. Thus, start-up funds, when forced to be spent in the first year or even two years, are not likely to be wisely used. They are often used to buy time sensitive reagents at a time when the faculty member is not able to use them. New faculty would appreciate an extension on start-up funds so that they may be purposefully used over a 3 - 4 year period.

2. Student undergraduate research demands by discipline

Although the historical strength of the WCU Biology Department is rooted within the organismal and ecological disciplines, the majority of recent undergraduate students appear to gravitate toward cellular/molecular courses or pre-professional/biomedical tracks. Thus, there is an inordinate demand for undergraduate research/capstone experiences on the current tenure-track faculty in the cell/molecular disciplines. For a student that just seeks to fulfill the requirement of a one semester BIOL-480 course, it is unlikely that the student will be able to move forward a research project that is meaningful for the faculty member’s scholarship. Although this short-term “one-on-one” experience may be highly meaningful for the student, the faculty’s tenure may be placed in peril. A Departmental Committee has reviewed the BIOL-480 requirements and has made recommendations (See report Appendix 1) that should help address some of these types of issues in the future. However, for the current tenure-track faculty, the Department may wish to provide some additional course release time for additional scholarship work in the 3rd or 4th tenure year as a good faith effort to assist the faculty with the process.

3. Promotions and compression

The Department appears to have encouraged faculty to seek rank promotion as appropriate and now has 2 full professors (5 including affiliated faculty), 8 associate professors, and 3.5 assistant professors. There appears to be a purposeful and appropriate desire to advance faculty through the ranks toward full professor. The Department also provided evidence that faculty are compensated for certain departmental responsibilities with course release or reassigned time. However, given the lack of

meaningful raises for nearly 8 years, faculty salaries are likely well under market value and compressed. Thus, there is a high risk for “brain drain” and the loss of faculty across the ranks to other institutions.

4. Laboratory and teaching spaces

At present, the Biology Department suffers from inadequate and subpar laboratory and teaching space. The infrastructure in the Natural Sciences (Programs and Building) is outdated, balkanized and places additional logistical strains on top of the inherent challenges of collaboration and interdisciplinary research at a predominately undergraduate institution. In addition, faculty offices are often disjointed from faculty laboratory space and may actually be in separate buildings. These issues should be addressed with the planned construction of a new Sciences Building. However, it is worth noting that in the near term these infrastructure challenges place yet another stress on the tenure-track faculty who rely on laboratory work as the core of their scholarship.

5. Field research/teaching and transportation

The historic and current strength of the Biology program is the ecology and evolutionary biology focus that uses western NC for both field research and teaching. As such, time in the field is the cornerstone of the student experience. Faculty have advocated for replacement vans, a necessary resource for field biologists, for what appears to be over a decade. These requests have not been fulfilled and have reached a critical point, both in terms of faculty morale and vehicular safety. This is a small, but important investment as these vans are part of the core identity of the Biology program. They also have marketing value as they are a visible and traveling representation of WCU at large, reflecting the quality and importance of field experiences for biology majors at WCU, and they epitomize what WCU has to offer for prospective students. The risks to student and faculty safety is also a major liability to the University, especially as the University has known about these safety issues for some time and has not acted to ameliorate the situation.

6. E&T fund allocation

In spite of increased enrollment, the departmental budget has remained flat and E&T funds have not kept pace with the increase in Student Credit Hour generation. In order for the Department to meet their mission and obligations, the faculty and leadership should work to address these discrepancies in a rational, predictable, and sustainable manner.

c. Teaching, Research/Creative Activity, and Service

The overall productivity of the Biology Department is excellent. The faculty are engaged and are model examples of the scholar-teacher in spite of inadequate laboratory and teaching spaces, high teaching loads, and limited molecular biology infrastructure. Faculty are regularly publishing in discipline journals and have an admirable track record of intramural and extramural funding given the institutional mission. There appears to be confusion about certain sponsored research policies (e.g. salary support or course “buy out” rates). These issues are likely a reflection of the complexities inherent in the varied funding sources and thresholds particular to the faculty disciplines. Although the Sponsored Research program at WCU has grown and improved considerably in recent years, these types of information deficits are common in smaller universities. Faculty should be encouraged to actively seek answers from Sponsored Research personnel directly, and clear, consistent and unbiased policies should be developed and disseminated for faculty research-related course releases.

Biology faculty have recently revived the Sigma Xi chapter and are actively involved in community engagement/outreach (e.g., “Science Café” at a local restaurant) as part of the chapter’s goals. There is also strong evidence of collaboration with the department, college, and throughout the university. The

Department plays a critical service role within the institution through liberal studies and pre-requisite courses for the health sciences. In addition, the faculty have engaged in cross-curricular teaching with the Departments of Philosophy & Religion, English, History, and Chemistry & Physics.

IV. ANALYSIS OF OPERATIONAL FACILITIES AND BUDGET

a. Does the program have adequate facilities to meet their educational mission?

As noted above, the teaching facilities are generally outdated, in poor condition and are poorly designed for the size and composition of the student body. Laboratories for some courses are offered in the Stillwell Building, which has been renovated relatively recently. However, many courses are taught in an older science building (NSB), which has poorly designed laboratories that are in a state of disrepair. In some cases, courses taught in the different buildings have to share teaching equipment, such that materials have to be moved between buildings on carts. This is a very inefficient use of time, further burdening teaching personnel. Recent passage of a North Carolina bond is expected to fund construction of a new building that should address the space problem. However, it was not clear whether the bond funding would adequately cover costs of new equipment for the new teaching facilities. Consideration for the costs associated with electrical, gas, vacuum, water purification, autoclaves, chemical hoods, and other related infrastructure, as well as specialized equipment will be critical for design, construction and maintenance of a new science building.

The need for new vans to support the field components of the departmental mission was a recurring theme at all levels during the site visit. The administration is keenly aware of this need. However, as reviewers, we are obliged to articulate our views on this problem. First we note that WCU is located in a globally recognized center of biodiversity. As such it has a unique opportunity for education and research related to organismal biology, ecology and evolutionary biology. A significant component of the curriculum is devoted to those areas. Although recent growth in the number of Biology majors is more focused on cellular and molecular biology, the absolute number of students interested in field-based studies has not declined. Accordingly, the need for field trips has not diminished. Given the geographic setting of WCU and the increasing awareness of climate change impacts on biodiversity, it seems unlikely that the future will bring a decline in the demand for these courses. Other than faculty, vans to transport students to field sites are the key limiting resource for delivering this component of the curriculum. Existing vans are outdated, not up to safety standards, and in poor repair. These inadequacies not only undermine the quality of the student learning experience at WCU, they place the students and faculty at risk, and place WCU in a position of considerable liability. The one-time investment needed to address this problem is small compared to the risks of continuing to use existing unsafe vehicles.

b. Does the program have adequate budget to meet their educational mission?

The Biology Department does not currently have the budget to continue to meet its educational needs without sacrificing the quality of field experiences and modern laboratory experiences. The department has experienced a very large increase in its undergraduate population and number of student credit hours delivered. At the same time, both the departmental operating budget and Educational and Technology fees have remained essentially unchanged. Concurrently with this departmental growth in students and teaching needs, the UNC system has undergone severe budget cuts, such that a lack of an increase in operating budget is understandable. However, Educational and Technology fees are collected on a per student basis. Thus, an increase in student credit hours should trigger a proportional increase in the share of fees distributed to the department. This is extremely

important to the quality of the student laboratory experience as laboratory teaching supplies are consumed on a per student credit hour basis. A consequence of the underfunded teaching labs is that faculty have been devoting some of their research funds to subsidize laboratory teaching. Given that research funds are also limited, this problem needs to be addressed immediately. Furthermore, even with a siphoning of funds from research programs, students have fewer supplies per students, undermining the student experience. Inadequate support of field courses (i.e., unreliable and unsafe vans) undermines the quality of undergraduate and graduate field courses and graduate thesis research.

V. SUMMARY OF PROGRAM STRENGTHS AND AREAS FOR IMPROVEMENT

a. What is your general impression of the program?

- The department is doing an excellent job with a very difficult task. They are working with outdated and inadequate facilities, and a very limited budget.
- The quality of the Biology programs appears to be appreciated by the administration as well as the other programs that they serve, and the administration recognizes that Biology is an area that needs resources.

b. Overall, what are the areas of strength?

- Faculty are committed and engaged with their students.
- Students are engaged with their program and have great respect for the faculty and the university.
- Programmatically, the greatest strength of the department lies in the areas of organismal, ecology, and evolutionary biology, reflecting the historic emphasis of the program, the research interests of the department, and the regional setting.
- Recent hires in the areas of cellular and molecular biology are bringing new technology into the department and moving the department forward in the direction of recent growth in the student body.
- The capstone course is a crowning jewel in the curriculum, and illustrates a strong commitment to student learning experience.

c. Overall, in what areas could the program make improvements?

- Ecology and Evolutionary Biology
 - New vans need to be purchased immediately to address safety issues, with the added benefits of improving the student learning experience and marketing the University.
- Investment and nurturing of the developing programs in cellular and molecular biology.
 - Limited start-up funding for new faculty needs to be made available for 3-4 years instead of two years.
 - A structured mentoring program for junior faculty should be developed and implemented
 - More strategic planning in delivery the curriculum is needed to reduce the teaching burden of faculty, especially untenured faculty.
 - Curriculum planning should be conducted in tandem with the ongoing planning of the new Science Building.

- Increased effort to offer group approaches to the capstone experience in order to continue to provide a quality experience to students without over-burdening faculty, especially untenured faculty. This could include moving the “capstone” experience to the freshman level for a subset of the students.
- Funding for graduate students needs to improve. Resources directed toward hiring adjunct term faculty to teach laboratory sections could be redirected toward increasing the number and size of graduate stipends offered.
- A structured TA training program combined with a formalized mentoring program, could help ensure teaching quality in laboratory courses.
- Departmental budgets are woefully inadequate for delivering the curriculum without sacrificing quality.
 - Educational and Technology fees need to be delivered to the department in proportion to the number of student credit hours taught.
 - Faculty should not be subsidizing laboratory teaching with research funds to compensate for inadequate funding of the teaching mission.
- External funding
 - Consider novel and creative ways to incentivize faculty
 - Grant writing workshops or financial support to engage grant writing consultants, especially for assisting junior faculty with proposal development
 - Teaching release time in exchange for submission of grant proposals

VI. SUMMARY OF RECOMMENDATIONS

The site review team was impressed overall, viewing the Biology faculty as well qualified and productive, and the degree programs as rigorous. Particular areas of strength include dedicated faculty, engaged students, commitment to offering a high quality capstone experience, an historic strength in organismal biology, ecology and evolutionary biology that is consistent with WCU’s regional setting, and an administration that recognizes that the department is doing a good job.

The team identified several areas where improvements could be made, many of which need to be addressed at administrative levels with added faculty and resources, but some restructuring could be done at the department level to increase efficiency. Administrative issues include purchase of new vans, redirecting some temporary teaching funds to support graduate-student teaching of laboratory sections, redistribution of Educational and Technology fees, redistribution of faculty start-up, and continued investment in growth of faculty in the cellular/molecular biology areas. At the department level, efforts to increase efficiency in delivering the curriculum, especially the capstone experience, which should be informed by a formal curriculum review; more structured faculty mentoring; more focused efforts on assessment; and incorporation of curriculum planning into new building design. These efforts would likely lead to enhanced program quality and sustainability and reduced burden on faculty.

APPENDIX 1. AD HOC COMMITTEE REPORT ON THE SENIOR RESEARCH REQUIREMENT

The ad hoc committee on the senior research requirement makes the following recommendations:

Considering that the primary goal of our senior research requirement is for students to have “the opportunity to synthesize knowledge, and demonstrate competence in technical, communication, and analytical skills by applying their knowledge and skills to a biological problem” (our QEP document from 2010). We also recognize that one-on-one faculty mentoring may not be the most efficient, nor in some cases most appropriate, approach to providing this research experience. We recommend the following options for satisfying the senior research requirement:

1. Senior thesis should become the preferred approach for one-on-one mentored research. Senior thesis is currently a 3-semester sequence with the proposal and committee developed during the first semester (BIOL 495, Introduction to Senior Thesis, 1 credit), the research accomplished primarily during the second semester (BIOL 498, Senior Thesis I, 2 credits), and writing and presentation of the thesis during the third semester (1 credit). In the past, we have been flexible in how we have administered the senior thesis with regard to what research courses the student had been registered in (e.g. BIOL 480, BIOL 493); the only firm requirement being that the student register for the final semester (BIOL 499, Senior Thesis II), have a mentor and committee, and produce a thesis. We recommend that this flexibility be maintained.
2. Research or professional internships (not job shadowing) should satisfy the requirement (BIOL 389, Cooperative Education in Biology, 3 credits).
3. At least 2 sections (cell & molecular and ecology & organismal) of a capstone course (2 credits) should be offered each semester. Faculty responsible for the course should rotate to keep capstone projects fresh, and release time should be provided for faculty offering the capstone experience for the first time (at least) to allow for development of a quality group research experience for the students. These courses could take the form of the BIOL 480 courses being offering by Martin and Youker this semester, or BIOL 414, Methods of General Microbiology, or more specific project-based format (there are many models of capstone courses available).

We also recommend development of a 1 credit hour course to be offered for the 1st semester junior year as a replacement for our current 1-credit hour BIOL 480. This course would focus on science as a way of knowing, experimental design and interpretation, and professional development.

In addition to this 1-credit course, we recommend that a methods-of-research course appropriate to the student’s concentration and interests (revamped and maybe renumbered BIOL 421, Principles of Biotechnology, or maybe BIOL 333, Cell and Molecular Biology with a more methods-oriented laboratory or BIOL 375, Methods in Ecology and Evolution) should serve as a prerequisite to all of the three options listed for satisfying the senior research requirement.

We also recommend that we more formally use BIOL 240, Introduction to Genetics, and BIOL 241, Introduction to Ecology and Evolution, laboratories as a means to introduce students to hypothesis testing, statistical description, and scientific writing. To accomplish this goal, we recommend an ad hoc committee be developed to explore which topics would be most appropriate to include.