

I. Program Review Documentation

**Department of Biology
Bachelor's of Science Program**

College of Arts & Sciences

2009-2010

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II. Biology Undergraduate Program Review: Self-study Executive Summary

The Biology Department has not had an external review of the program since 1999 although the faculty have evaluated the program in numerous ways more recently. In 2006, we implemented a revised and strengthened curriculum that is working quite well and is being continuously fine-tuned. We also initiated strategic planning at the time that our curriculum was being developed. These actions poised us well for last year's initiation into participating in the University's Quality Enhancement Plan (QEP), in which we are making our core curriculum more robust and assessable. Included in the QEP are elements of the University's Strategic Vision and the University of North Carolina's UNC-Tomorrow recommendations for engagement with the populace of the state. We appreciate this opportunity to share our plans and successes with external peers and will readily accept suggestions for program improvement.

Our infrastructure has improved noticeably with the recent renovation of the Stillwell Science Building in 2008. Classrooms for our freshman majors laboratory courses, Liberal Studies (General Education) labs, and upper-level lab rooms for cell and molecular biology and microbiology are outstanding. Several faculty offices are in this building as well and are a marked improvement over the old space in that building. Research space has also been improved, though only one research laboratory for Biology faculty (the shared laboratory of Dr. Bose and Dr. Costa) is in the new space. However, this laboratory is state-of-the-art. Shared research space for tissue culture work, microscopy, autoclaving, and other activities is present in the Biotechnology Core Facility on the ground floor.

While the Natural Science Building has issues that will be discussed later in the self-study, we are also working to improve this space. A group of Chemistry & Physics and Biology faculty submitted a grant in August to the National Science Foundation (NSF) to renovate the research spaces in this facility. Some remodeling has also occurred on the ground floor for the Forensic Science Program as well as space on the first floor that was formerly occupied by the Anthropology and Geology Departments (now the research laboratory spaces for Drs. Collins, Hyman, and Pechmann). Teaching space for the 200-level majors, Anatomy and Physiology courses, and 300 to 500-level ecology and organismal biology labs are less modern than those in Stillwell, but have been adequate. Minor remodeling in these rooms would be a distinct improvement.

The Biology faculty have been active in obtaining funding for both research and teaching, bringing in more than \$2.6 million in the last five years. Funding sources have included the National Science Foundation, North Carolina Biotechnology Center, Department of Interior, and educational granting agencies. We have partnerships with many groups including the Eastern Band of Cherokee Indians, National Park Service, and North Carolina Department of Education. Dr. Jim Costa has a remarkable record of support as the director of the Highlands Biological Station, a field station that our University administers and with which we have a revitalized relationship. Dr. Beverly Collins is also overseeing the development of the Southern Appalachian Biodiversity and Ecology Center (SABEC), which works to integrate our department's activities with regional ecosystem concerns. The B.S.Ed. program in Biology, which is administered by Dr. Kefyn Catley, is well funded and set to embark on

some major improvements recommended by the state. We greatly value and support the mission of training tomorrow's secondary education science teachers.

The Biology faculty believes that the department is understaffed, under-resourced, and is in desperate need of a full time administrative assistant in the office to help support our programs (including the B.S., B.S. Ed., M.S., M.A.T, and M.A.Ed.). As suggested above and throughout this report, we are a proactive and collegial faculty and are willing to work diligently to further our mission of providing the best education for our undergraduates. We realize this means that they need to be introduced to the latest scientific methods and findings, be taught in an engaging and inquiry-based environment, and be encouraged to take part in independent research. For these things to happen, the faculty must have the resources to conduct their own research and receive credit for spending time with undergraduate and graduate students in the lab and field. Currently, our advisee loads and faculty to student ratios are among the highest in the College of Arts & Sciences. Furthermore, our freshman through senior majors constitute the largest demographic of majors in the college.

We would like tenure track faculty positions allocated to our department next year. Our critical need is in cellular and molecular biology/biochemistry; however other positions will be needed as the number of introductory courses we offer continue to swell and as our junior/senior cohort increases in size. We have also reached the point where a lab technician and other support personnel are necessary for the smooth running of the department. We have a scanning laser confocal microscope, automated capillary DNA sequencer, and real-time PCR machine that are not well-maintained and could be put to greater use if they were kept in operational condition. The department would also benefit by having a qualified person capable of making stock reagents and chemicals, running simple experiments, and providing basic lab skill training to undergraduates. Laboratory space, start up funding, and infrastructure support are also needs of the department. We are thankful that the administration has purchased maintenance contracts for some of our equipment. We also hope to receive funds requested from NSF to renovate research space in the Natural Science Building. In the long term, we look forward to having a new science building.

In the meantime, we have been working and will continue to work to find funding for research and involving our students in scholarly activity in the lab and field. Research is a critical part of our mission and any support from the University will be viewed as an investment that will be repaid by orders of magnitude in external funding. This has been our track record and will continue to be our culture. We appreciate any assistance we can garner and will keep our students and their development at the forefront of our thinking. This is reflected in also supporting our faculty on tenure track, who often are the most popular mentors for our students. Any support the department can give these faculty is a priority – this was a stated goal of Dr. O'Connell and Dr. Rundle when they assumed leadership of the department. We will put our budget to the best use by providing the necessary resources for faculty development. We are optimistic that the college and university administration will financially support our efforts in enhancing faculty development, improving infrastructure, and hiring staff and faculty to help us excel in the various missions of the department, college, university, region, and state.

Standard 1. The purpose of the program reflects and supports the mission and strategic vision of Western Carolina University and the mission of its College.

The purpose of the biology undergraduate program at Western Carolina University is to provide a high quality experience to our majors while preparing them for employment or further studies upon graduation. We have developed a program that shows both depth and breadth in the sub-disciplines within biology, and is competitive with other colleges and universities. Our class sizes are relatively small, faculty are accessible outside of class times, and our faculty keep up to date on teaching and research pedagogies. The majority of our majors identify themselves with pre-health professional career interests (e.g., medicine, pharmacy, dental, and veterinary sciences), while a smaller group is interested in molecular biology or ecology and evolutionary biology. Engaged learning and ties to the region are themes that the Biology Department embraces and we are a pilot program for implementing the Quality Enhancement Plan as approved by SACS (Appendix 1 for the QEP plan). As part of the QEP, we are requiring seniors to take part in research as a capstone experience and also incorporating standards within the degree program that can be monitored and assessed as our majors progress toward their degrees.

Western Carolina University views itself as a regionally engaged university (see *Western Vision Statement* in Standard 1 Appendix), and the Biology program has a long tradition of being regionally engaged. Distinctive aspects of the Biology program include our location in the Southern Appalachians, home of one of the most diverse floras and faunas in North America. WCU faculty and staff have access to many nearby field sites, including the Nantahala National Forest, the USDA Forest Service's Bent Creek Experimental Forest and Coweeta Hydrologic Laboratory, Great Smoky Mountains National Park, the Blue Ridge Parkway, the Waynesville Watershed, Balsam Mountain Preserve, and WCU's own Wolf Creek Watershed Natural Area and West Campus Outdoor Laboratory. The Biology program benefits from coursework and research opportunities available at the Highlands Biological Station, which is administered through WCU. WCU's Southern Appalachian Biodiversity and Ecology Center (SABEC), a resource for education, research, and service focused on the biodiversity and ecology of the region, facilitates collaborations between the Biology program and other programs within WCU, as well as with other regional institutions (see Appendix 2).

The above illustrates the strength of the program in serving students interested in Ecology, Conservation Biology, and Biodiversity. This strength is matched by the research interests of many of the faculty. The weakness of the program is its lack of uniqueness in other important aspects of biology: cell biology, molecular biology and biochemistry. The number of faculty and course offerings in this latter area are more limited, and students attending WCU to pursue a degree focused on molecular biology have

fewer choices in advisor and appropriate courses. Of the 11 tenured and tenure track faculty with full time appointments in Biology, only four have active research programs involved in cellular and molecular biology (one is on a leave of absence for 2009-2010 and three are untenured).

The Biology program is aligned with appropriate parts of WCU's 2008-2013 Strategic Plan, the UNC Tomorrow recommendations, and the College of Arts & Sciences mission (see Appendix Standard 1). Highlights summarized from the Strategic Plan include:

Strategic Direction 1: Prepare students to meet 21st Century needs and demands.

The Biology Department has traditionally focused on engaged scholarly activities focused on the needs of the region and the state of North Carolina. For example, students have studied the effects of various invasive species on the ecosystems of the western North Carolina.

Strategic Direction 2: Serve the educational needs of North Carolina.

Our department supports the Secondary Science Education program (B.S. Ed.), which provides broadly trained science teachers for the state of North Carolina. Many of our alumni are high school teachers in local schools.

Strategic Direction 3: Improve public education.

Our department supports the Secondary Science Education program (B.S. Ed.), which is administered by Dr. Kefyn Catley. In addition, Biology faculty support regional schools in many ways. For example, the Western North Carolina Regional Science Fair is organized by Dr. Catley and many Biology faculty and students serve as judges.

Strategic Direction 4: Promote economic and community advancement in Western's region.

Our program trains cellular/molecular biologists to work in biotechnology industries, and ecologists/conservation biologists who can work for consulting firms and government agencies that help strike a balance between protecting the region's natural resources and development. We also prepare students for acceptance into graduate and professional programs that upon completion, enables our alumni to work in the area.

Strategic Direction 5: Improve health and wellness in Western North Carolina.

Our program trains students to participate in local health care as well as to work in biomedical research and industries. For example our students work or perform cooperative education projects with local family practice physicians. We also educate environmentally-minded students who provide outdoor recreational opportunities in the region. Please see section 4 above.

Strategic Direction 6: Model environmental sustainability.

A significant portion of our program's coursework and research training focuses directly on the

stated goal of this strategic direction: “Western will expand its focus on education and research tied to environmental sustainability with particular emphasis on biodiversity and land use resources.” While our ecology and evolutionary concentration is relatively new and a small part of our program, we anticipate it will grow substantially in the near future.

Strategic Direction 7: Promote outreach and engagement within the region.

We provide students with opportunities to work with public and private entities within western North Carolina. For example our students and faculty serve as judges for the regional science fair.

Standard 2. The program engages in ongoing, systematic planning that is reflective of the University’s strategic priorities

The Biology Department’s Undergraduate Program has not undergone a formal/external review for at least 10 years. However, in concert with a review of our Graduate Program in 2004-5, we took it upon ourselves to develop a Strategic Vision Statement and an Action Plan (see Standard 2 Appendices). In March of 2008 we re-visited these documents and developed a new 5-year plan (Appendix for Standard 2). As we looked toward the future, it was gratifying to discover that many of our significant 5-10 year goals set forth in 2004 had been met or surpassed in only 4 years (Appendix for Standard 2). In March of 2009 we developed a much more far-reaching and detailed Quality Enhancement Plan (Appendix for Standard 2). Clearly the most far-reaching development in our undergraduate program over the past 5 years was the implementation of a completely revamped curriculum in the fall of 2006. A critical feature is the requirement that all of our majors engage in a minimum of one semester of independent research with a faculty member. Assessment of this curriculum is ongoing and is being refined by the implementation of the QEP objectives this year. The goals, parameters, and assessment procedures for this aspect of the Program are detailed extensively in the Appendix for Standard 2. And, while we continue to enjoy successes, our biggest obstacle for furthering our goals and objectives is limited resources (see Standard 7).

The Biology Department is a much different department this year than it was in 2004-2005. We have 18 faculty that teach at least one course per year in the department and 14 mentor students in research. Eight of these faculty have been hired since 2004-2005 and five are on tenure-track. We are also seeing a rise in majors as the university’s population grows. Our department’s Curriculum Committee is currently making adjustments to the curriculum, including enhancing our pre-health professional and ecology and evolutionary biology concentrations to better reflect the goals of our QEP. The department’s Collegial Review Committee has recently revised our Tenure, Promotion and

Reappointment (TPR) document in response to the reclassification of scholarship (i.e., the Boyer Model) on campus. Other committees (e.g., QEP implementation group, strategic planning committee, pre-professional advising committee) are formed as necessary to plan for and recommend changes to our program.

Standard 3. The program provides and evaluates a high quality curriculum that emphasizes student learning as its primary purpose.

From 2004-2006 the Biology Department undertook a two and a half year planning process to revitalize our undergraduate curriculum. This work entailed an exhaustive review of biology programs at universities designated as our peer institutions, an examination of admissions requirements for medical and other professional schools as well as graduate programs in biology, and negotiations with various curriculum bodies and administrators on campus. The major changes to the program in 2006 included the following:

- Phasing out of Business, Horticulture, and Environmental Health concentrations, which were replaced by Ecology and Evolutionary Biology, Molecular Biology, and General Biology concentrations (Pre-Professional became the Pre-Health Professional concentration).
- Removal of the foreign language requirement (12 hours) to be replaced by Biology electives.
- Development of a new core sequence in Biology, including the design of two new courses, BIOL 240 (Introduction to Genetics) and BIOL 241 (Introduction to Ecology and Evolution).
- Requirement of all majors to participate in research during the senior year.
- Requirement of all majors to complete a full year of Physics (PHYS 130/131), one semester of General Chemistry (CHEM 140), two semesters of Organic Chemistry (CHEM 241, 242, 272), a course in Calculus (MATH 140), and a course in statistics (MATH 170).
- Development of broad electives in Biology (including up to two courses in Philosophy, Geology or Chemistry) ensuring students would have flexibility in choice.

Our curriculum is designed so that students begin in BIOL 140 (basic cellular and molecular biology) and progress through the core (BIOL 141: diversity of life; BIOL 240: genetics; BIOL 241: ecology and evolution). BIOL 333 has been targeted as the “gateway” course in the QEP for our Pre-Health Professional and Molecular Biology concentrations and BIOL 375 (Methods in Ecology) is the

gateway for the Ecology and Evolutionary Biology concentration. Students in both courses (as well as students in BIOL241) will submit work as part of an “electronic briefcase” (portfolio) that will become part of their record. Learning outcomes from the new curriculum include the ability to articulate biological concepts, apply biological theory to concepts, perform lab and field methods and evaluate data, and synthesis of knowledge from the above activities. In class assessments from BIOL 140-241 showed acceptable competence in the core of biology in 2007-2008 (>70% correct responses on exams) but some drop off in 2008-2009 (BIOL 140, 141 were < 70% correct response). We will need to take a closer look at this after this year, and compare these figures to QEP learning outcome assessments.

Depending upon their concentration, students take three required courses (e.g., for Pre-Health Professional majors, these would be BIOL 311, 333, and 361, or Animal Physiology, Cell and Molecular Biology, and Biochemistry, respectively), and choose a prescribed number of electives within five “elective sets”. The elective sets are designed so that students will gain competency in cellular and molecular biology, organismal biology, ecology and evolutionary biology, conservation biology, and biotechnology. The final requirement for our majors is research experience. This now serves as our capstone for the major, rather than our former Senior Seminar course. BIOL 480 is the main research course that students sign into and is designed to fit within the broad goals of the QEP. The course includes discussions in research ethics, how to prepare a CV and apply for employment and admission into professional or graduate programs, as well as taking part in independent research (research proposal preparation, research execution and presentation of independent work). Students are also eligible to gain credit for attending our weekly seminar series (all do so as part of BIOL 480).

The sizable number of hours (29 credits) in math, physics, and chemistry needed in the major reflects requirements for admission into post-baccalaureate programs and also helps to maintain rigor of our program and promote advanced analytical and problem-solving skills of our majors. Please see the Appendices for Standard 3 to view our program description, course descriptions, advising checksheets for each concentration, eight semester plans, and syllabi for all courses.

As part of our curricular reform, we decreased the number of hours required to graduate from 128 to 120. Our students have had very few problems in graduating in four years, even while taking on double majors, minors, and additional coursework to prepare them for various career paths. The nature of our program is inter- and multidisciplinary in the sciences, with math, physics, and chemistry serving as the foundation of biology and also enhancing the applications of biology that our students experience. We also encourage students to think outside of the sciences, for instance, by allowing them to take two

non-biology courses such as philosophy courses in biomedical ethics and wilderness ethics. Our Liberal Studies (General Education) program also ensures that our majors will be exposed to the humanities, history, social sciences, arts and music, foreign culture, and other disciplines that will enrich their education and life-long learning.

The schedule of our classes and two-year rotation for upper level courses are shown as documents in Appendix 3. Fall of 2009 saw a large spike of ~1,550 freshmen enroll at WCU and this in turn was reflected in an increase in enrollment from 172 to 235 students from fall 2008 to fall 2009 in BIOL 140 (which includes students with majors in chemistry, forensic science, nutrition and dietetics, etc., as well as biology). We anticipate a continued increase in majors especially in the Pre-Health Professional fields. This rise in interest in our program will ripple throughout the degree and necessitate examination of the numbers of sections of each of the core courses, the breadth of upper level electives offered, and faculty to staff these sections. For spring 2010, we are already at or exceeding capacity for all of our BIOL 140-241 courses.

The number of Biology graduates has varied since 2004, but is increasing overall, with 47 graduates in 2009 compared with 21 in 2004. The number of juniors/seniors in the major has also risen, from 69 to 91 in this time period and the four-year graduation rate has decreased from 4.71 years in 2006 to 4.22 in 2009. The latest census of declared Biology majors is 254 from the freshman to senior years, so it is likely that junior/senior numbers will rise and the number of graduates will remain high.

Standard 4. The program has sufficient faculty resources to meet its mission and goals.

Faculty credentials are consistent with SACS standards in terms of appropriate degrees, related work experiences, honors and awards, and demonstrated competencies and achievements that contribute to effective teaching and student learning outcomes. There are 18 full-time faculty in Biology (fixed term, tenure track, and tenured) and an additional faculty member, Dr. Bose, who is on a one year leave of absence from her tenure track position.

There are four major concentrations in the B.S. in Biology program: Ecology and Evolutionary Biology, General Biology, Molecular Biology, and Pre-Health Professional. The Biology faculty have expertise in the following areas:

- Molecular biology of plant development (*Rundle*)
- Molecular biology of yeast (*Bose*)
- Molecular pathology (*Bose, Seischab*)
- Control of gene expression (*Coburn, Rundle*)
- Immunology (*Powell*)
- Biophysics (*Seischab*)
- Microbial ecology and diversity (*O'Connell*)

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- Evolutionary genetics (*DeWald, Mathews, Pechmann*)
- Environmental biology (*Adkison, Costa, DeWald, Himes*)
- Population and community ecology of animals (*Costa, Kandl, Pechmann*)
- Population and community ecology of plants (*Collins, DeWald*)
- Aquatic ecology (*Martin*)
- Conservation biology (*Collins, DeWald,*
- Botany (*Collins, DeWald, Mathews, Sharma*)
- Systematics of plants (*Mathews*)
- Systematics of spiders (*Catley*)
- Animal behavior (*Hyman*)
- Ornithology (*Hyman*)
- Herpetology (*Pechmann*)
- Parasitology (*Powell*)
- Human Genetics (*Michaelis*)

The strength of the faculty involved in research tends towards the ecology and evolutionary biology areas of Biology (9 faculty; one on tenure track) compared to the cell and molecular biology and biochemistry area (4 faculty; three on tenure track). The department is critically aware that it is understaffed and has more junior faculty in cell and molecular biology areas.

The Biology faculty is comprised of two full professors, eight associate professors, four assistant professors, two instructors, and three lecturers. The latter two categories are non-tenure track positions; the instructors are full time and the lecturers are 80% time (with full benefits). The faculty range in age from early thirties to late fifties. Ten faculty are male, nine faculty are female, two faculty members are non-Caucasian. As indicated in the Appendices for Standards 4 and 5, the faculty demonstrate continuing growth as professional practitioners, teachers and scholars. Biology faculty regularly attend and present their research at regional, national and international conferences in their field, and also participate in teaching improvement workshops at conferences and at WCU's Coulter Faculty Center.

Professional and pedagogical development opportunities for faculty are provided by institutional resources including: the Chancellor's Travel Fund for presentation of scholarly work at a conference (\$1,000), Faculty Research Grants (\$5,000), Hunter Scholar Award (1 course release plus graduate assistant), the Provost's Instructional Improvement Grant (\$1,000), Faculty Center Microgrants for travel to workshops related to teaching improvement (\$700), and the Scholarly Development Assignment Program (one semester paid leave plus one semester unpaid leave). Seven of our current faculty have taken advantage of one or more of these programs: Drs. Collins, Costa, Martin, Mathews, O'Connell, Rundle and Seischab. In addition, our faculty are continuously updating the curriculum for the B.S. in Biology and are using new techniques to teach various subject areas in biology. The University and UNC system offers several teaching awards, of which Dr. O'Connell has received four.

There is excellent collegiality among the Biology faculty as expressed in the constructive

outcomes and congeniality of faculty meetings, collaborative instruction and research among Biology faculty and a generally positive workplace environment. For example: Drs. Collins and Pechmann co-teach several courses and Drs. O'Connell, Seischab and Rundle collaborated on an educational improvement grant to purchase equipment to enhance the learning experience of students in a number of courses. In addition, Drs. Seischab and Adkison are collaborating on research in cell biology while Drs. Pechmann and Hyman have assumed leadership of student-based salamander surveys that have been ongoing for over 30 years. The standard teaching load of the faculty is 9 credit hours or 12 contact hours per semester. The percentage of reassigned faculty time in Biology per semester is: 50% for the Department Head (O'Connell), 16% for the Associate Department Head (Rundle), 25% for the Graduate Program Coordinator (Rundle), 50% for the Science Education Coordinator (Catley; other teaching assignments are in the Education department), 84% for the Director of the Highlands Biological Station (Costa), 75% for the Environmental Science Program Director (DeWald; other teaching assignments are in the department of Geosciences/Natural Resources Management and in the Environmental Sciences Program), and 16% for the Herbarium Director (Mathews).

As part of a university-wide initiative to clarify standards for tenure, promotion and reappointment (TPR), the department has just adopted a revised Collegial Review Document (CRD). The document language was thoroughly discussed and approved by the tenured and tenure-track faculty. In addition to the university-level review, the department conducts annual faculty evaluations (AFE) of all full-time faculty, which adhere to the guidelines of our AFE document. Both documents are attached in the Appendix for Standard 4.

The Biology Department offers both the B.S. and M.S. degree and the demographics for each degree program are quite different, with more cell and molecular biology-interested students in the undergraduate ranks and ecology and evolutionary biology-focused students at the graduate level. Distribution of faculty resource, therefore differ between the graduate and undergraduate programs, making it difficult to neatly categorize the load for a faculty member. For example, research advisors in ecology fields have more graduate students while faculty in molecular biology train fewer M.S. students. On the other hand, undergraduate students, geared largely towards cell and molecular biology generate larger class sizes in upper level courses and are a main constituent of our Senior Research course (BIOL480). We are beginning to explore ways to more uniformly quantify faculty load in terms of assigning credit to working with students in the lab and field. It is clear that undergraduates gain valuable experience, confidence, and skills via research and this is often accentuated by working with graduate students. Faculty should receive more recognition for this aspect of their job, given its great rewards

countered by its time-intensiveness and possible impediment to their own research goals.

Standard 5. The program attracts, retains, and graduates high quality students

Biology's undergraduate program has about 250 majors. The Pre-Health Professional concentration attracts most of our majors (58%). The other biology majors are in the General Biology concentration (13%), the Ecology and Evolution concentration (9%), and the Molecular Biology concentration (6%). Another 13% are undeclared or following an older plan of study. Lastly, 16 additional students are in the Secondary Education in Biology concentration. On average, 80% of biology majors at WCU are white, 10% are African American, 4% to 6% are Hispanic and 2% are Native Americans and Asians (please see Appendix for Standard 5). The diversity of our student body is atypical for the Western North Carolina region, which is predominantly Caucasian but also includes the Eastern Band of the Cherokee. Much of our student body's other ethnic diversity emanates from Mecklenberg (Charlotte area) and Wake (Raleigh area) counties. Nearly 58% of the Biology majors are female and 47 total students graduated from the program in 2009. Please see the Appendix for Standard 5 for more information on demographics and qualifications of the Biology majors.

We teach another 400 to 500 students in our introductory courses for majors (our 140 series) each semester. These numbers count students twice, once each for lecture and lab components of the courses. These classes also include students from other disciplines. Roughly 150 students take our 240 series each semester. These are mostly biology majors. Three of our 200-level courses (Anatomy and Physiology, Human Physiology, and Dendrology) typically serve 300 to 370, mostly from outside Biology each semester. We typically teach 250 to 300 students in our upper level courses (300/400) each semester. Our Liberal Studies courses (102-105 and 190s) serve 300 to 500 students each semester.

All of our tenured and tenure track faculty members advise students as do two of our fixed-term faculty members who are on multi-year contracts. An effort is made to match a student's concentration to the advisor's area of expertise, although assignments are sometimes based on other criteria including advisee load. All advisors use a set of check-off sheets to keep up with the progress of advisees (see Appendix for Standard 3). These sheets are maintained in individual student folders. Students who begin their career in our program have the convenience of following 8-semester plans that can be found on our website (Standard 3 Appendix also shows these plans). As part of our QEP, we implemented a series of general meetings during the 2009 fall semester in which one of four faculty members individually meet, respectively, with freshmen, sophomores, juniors, and seniors. These general meetings precede advisee

appointments with advisors, and are meant to prepare students for their advising sessions and make the advising sessions more effective as well as to give pertinent information to each class related to scholarships, research opportunities, and graduation information, for example.

Freshman and transfer students are advised first by the WCU Advising Center before being assigned an academic advisor in the department. We work closely with the Advising Center to ensure that the students will receive the best advice about which courses to take and when. A joint effort by the Biology Department, Chemistry and Physics Department, and Honors College has led to the reconstitution of the Pre-Professional Advising Committee. This committee serves to better prepare our students for entry into veterinary school, medical school and other health-related programs.

The Biology faculty provides a range of research opportunities to Biology majors (Appendix for Standard 5). More than 50 of our students over the last three years have worked on projects ranging from ecology and systematics to physiology and medical genetics. Many of them have investigated the identity of microbes in Great Smoky Mountains National Park, which teaches both ecological principles and molecular techniques. Others have studied bird behavior, insect behavior, arthropod communities, plant communities, genetic diversity of economically important plants, the genetic basis of Alzheimer's Disease, forensics, cell culturing, medicinal properties of local plants, assays of potential antibiotics, etc. A number of these projects have been presented at local symposia as well as regional and national conferences.

Roughly 10 Biology majors have participated in cooperative education (Appendix for Standard 5). These co-ops have included work at veterinary clinics, agricultural extension agencies, an orthopedics clinic, and even a medical service trip to Africa. A handful of our students have also studied in Ireland, Australia, Mexico, and American Samoa (Appendix for Standard 5).

The Biology Club usually attracts several students each year. The club helps maintain our local plants garden (Cherokee Gardens, located between the two science buildings) and usually participates in an annual roadside clean-up. Members have organized hikes and other outings. Differences in opinion among members about the purpose of the club and leadership roles often results in loss of interest and waning activity by year's end. Nevertheless, the club tends to be revived every year or so by new students who bring fresh perspectives.

Our main recruiting activity involves two to four Open House events each semester. One faculty member typically meets prospective students for roughly two hours in a general location where all the

university's programs are promoted using display boards, pamphlets, handouts, and conversation. We follow this session with a half-hour tour of Biology's facilities led by a second faculty member from the department. A few enthusiastic guests often extend the tour to roughly an hour. We also use our website to recruit students. It provides information about each faculty member's interests and special opportunities for our students as well as information about courses, scholarships, staying on track for graduation, and careers following graduation. As an example, the website received 796 visits during October 2009, with 311 of those visits being from different people/computers. About half of the visits come from Google and Yahoo searches. Lastly, WCU has changed the manner in which the Admissions Office recruits students generally. This spring, our faculty will receive names of outstanding high school students who have applied to the university and expressed an interest in Biology. We will make personal phone calls to these students and encourage them to attend WCU. In the past, many of these students subsequently attend WCU on merit scholarships.

In addition to the processes/activities identified in the previous section, we work to retain students by making our classes interesting and engaging, by maintaining a nicely furnished "Student Preserve" (lounge and commons area), and by providing opportunities for students to work one-on-one in labs and in the field with faculty members and graduate students. Our ecologically oriented classes usually include weekend field trips and afternoon trips to the Blue Ridge Parkway, Great Smoky Mountains National Park, surrounding national forests and holdings by conservation organizations, local rivers/creeks/streams, and trips to museums, aquaria, etc. Students also have numerous chances to interact with faculty in the hallways and offices due to the small faculty to student ratio and intimate campus setting. Conversations with students in this context bolster their confidence and allow them to explore class topics more informally: this leads to better chances of retaining students in the major.

We offer six scholarships annually to undergraduate students majoring in biology. The Ramsey Family Scholarship is our most prestigious award and pays one year of in-state tuition to a student who is majoring in biology with a concentration in Pre-Health Professional studies. The Anastasia 'Stacy' O'Connell Research Scholarship pays \$1000 toward tuition and \$500 for research expenses to a Junior or Senior student with interest in fields related to breast cancer. The Rice Family Scholarship, the Biology Department Scholarship (each worth \$1000), the Betty Rundle Scholarship, and the J. Gerald Eller Scholarship (each worth \$500) are awarded each spring to biology majors who show promise of a successful career in biology. This year we are also initiating awards for Biology majors that may not require financial assistance yet deserve recognition for their superior performance. One award will be

given to the senior with the highest GPA and another to the student with the best record in independent research.

Standard 6. The program has an administrative structure that facilitates achievement of program goals and objectives.

The Biology Department is under new leadership and a new administrative structure starting this year. Our new Department Head (DH), Dr. Seán O'Connell, shares administrative duties with an Associate Department Head, Dr. Sabine Rundle. Please see the Appendix for Standard 6 for the roles of each administrative faculty as well as the overall organizational structure for the College of Arts & Sciences and Division of the Provost (Academic Affairs). Drs. Rundle and O'Connell took over leadership of the department in late September 2009 on short notice. Their plans for major initiatives in the department are included in the documentation mentioned above. These goals include the staffing of the office with a full time secretary, new faculty position(s), improvement of the current curriculum, funds to respond to the quick rise in enrollment and class sizes, funds to improve infrastructure, funds to aid tenure-track faculty in their research programs, and a technician/instructor to assist the DH in keeping his teaching and research programs running.

Committees that serve the department include the Curriculum Committee (chaired by Dr. Tom Martin), Biology Awards Committee (chaired by Dr. Chris Coburn), Graduate Committee (chaired by Dr. Rundle), QEP committee (chaired by Drs. DeWald and Rundle), AFE-TPR Committee (chaired by Dr. O'Connell as an *ex officio* non-voting member), Undergraduate Program Review Committee (chaired by Dr. O'Connell) and Graduate Program Review Committee (chaired by Dr. Rundle). Business deliberated by each committee is brought to the full Biology faculty for discussion, modification (if necessary), and approval.

The DH attends numerous meetings and workshops throughout the year to ensure that he is up to date on the latest information necessary to make appropriate administrative decisions. Faculty are continuously studying and improving the quality of the curriculum by eliminating old courses that no longer serve student needs and introducing new classes more appropriate to training today's scientists. Tenured biology faculty form the departmental Annual Faculty Evaluation and Tenure, Promotion and Reappointment (AFE-TPR) committee. Membership is determined by election involving the entire Biology faculty. Members of the Biology faculty also serve on the College and at times the University TPR Committees. The Department Head, the Dean, and Associate Deans of the College of Arts and Sciences are all evaluated by the faculty on a yearly basis.

Currently little input is sought from alumni and other program constituents regarding the B.S. in Biology degree: evaluation of peer departments has been the basis for our curriculum changes. Students provide input informally by conversation as well as anonymous course evaluations, and student requests for specific courses offerings have been met whenever possible. Starting in the fall of 2009, we have implemented exit interviews for graduating seniors. Five students took part in these interviews and summary comments will be made available for the reviewers of our program.

Standard 7. The program has adequate resources to meet its goals and objectives.

The monies available to the biology undergraduate program are not separate from those available for the graduate program. These moneys come in the form of two funds: a general Biology Fund and an “Education and Technology” (E&T) fund (see Appendix for Standard 7). These funds differ in that the E&T funds are generated through a specific student fee and are restricted to being spent on educational expenses. The amount available from the budget line for the Biology Fund has not changed in quite some time (\$40,804) and the E&T fund has only recently increased after being stagnant for many years (this fund rose from \$15,791 to \$23,404 for FY2009 and 2010). It is noteworthy that the general Biology Fund must cover all costs, including but not limited to, educational supplies and technology (once the E&T funds are exhausted, typically 6 months into the fiscal year), office supplies, photocopying, postage, faculty travel and development (including registration fees), equipment costs, facilities management fees, etc. This budget was inadequate in 2004. In essentially every parameter measurable regarding serving student needs, majors and non-major alike, we have seen very significant increases in demand over the past few years, yet the budgets remain relatively flat, especially when adjusted for rising costs in necessary materials. As part of our QEP implementation this year, we are receiving a one-time boost of \$8,000 to support undergraduate research. We cannot overstate how beneficial this supplemental funding has been.

The offices, teaching laboratories, and research laboratories located in the Natural Science Building were designed and outfitted over 30 years ago. The electrical and mechanical infrastructure of the facility is inadequate and frequently results in power outages, leaks, and loss of climate control. Power outages in particular, some of which are deliberate, have resulted in losses of tens of thousands of dollars in real goods, and untold losses in research time and effort. A recent WCU capital improvement plan included a request for a new science building, which was ranked seventh in priority. Its current status is unknown. Teaching and research laboratory space in the Stillwell building were renovated in 2008, but the majority of Biology research space is in the dated and inadequate Natural Science Building.

The newly renovated research space in Stillwell provides facilities for some common use areas for genetics, microbiological, and tissue culture research as well as microscopy facilities. A DNA sequencer, real-time PCR machine, and Li-Cor instrument are housed in Natural Science Building (see Appendix for Standard 7 for more equipment and facilities information). While the research space in the Stillwell building is limited for biologists, the new classrooms are an enormous positive factor in improving the quality of instruction for our students. All Liberal Studies and introductory biology (BIOL140/141) laboratory sessions are held in new, spacious and well-designed rooms. Special preparatory areas are present for each classroom and all classrooms have a computer and electronic projector. A new Microbiology/Molecular Biology classroom and a preparation room provide a true research environment for upper level students and have been equipped with a \$70,000 grant from the North Carolina Biotechnology Center. Lastly, a beautiful herbarium with new opportunities for teaching has been installed and is maintained in prime condition by Dr. Mathews.

Recruitment of top-notch faculty is severely hindered by our infrastructure and low investment in lab start-up. Start-up funding (usually about \$16,000) for new faculty continues to be very inadequate. In recent years, start-up funds have been allocated with only a portion available in each of the first two years, further decreasing the purchasing power. Thus more expensive pieces of needed equipment must be purchased with external funding. While some pieces of expensive, but needed equipment have been purchased through external funds, needs for less specific equipment (e.g. vehicles, freezers, ovens, computers, compound microscopes) often go unfunded by granting agencies because they are considered to be part of the normally available infrastructure of a university. Perhaps the best examples of aging departmental equipment that receives a tremendous amount of use, but that is too expensive for the department to replace are our two vans (13 and 15 years old) used for class field trips and research travel. Maintenance and repair costs continue to climb for both vehicles and we worry that they pose safety risks.

All instructional spaces in the Natural Sciences Building and Stillwell Building (except most teaching labs in Natural Sciences) have been supplied with computers and digital projectors. Network connectivity has been greatly improved by the expansion of the campus Wi-Fi network. Each faculty member is supplied with a computer upon hire, although university-provided computer refreshes have only been sporadic for the past five years due to budgetary constraints. Library resources have been greatly expanded over the last five years by providing electronic access to a large number of relevant journals (please see the Appendix for Standard 7).

One of our goals over the last five years has been to take advantage of our location in the southern Appalachians and expand our program in the area of biodiversity studies. The makeup of our

current faculty reflects that emphasis, with nine tenured/tenure-track faculty active in research in the broad area of ecology and evolution (one is on tenure track) and only four in the broad area of cell and molecular biology (three are on tenure track). The increasing demand placed on the four faculty members with active interests in cell and molecular biology by the undergraduate program, which is dominated by students in the Pre-Health Professional concentration, reduces their effective involvement in the graduate program and also limits the upper level course offerings we would like to provide for our undergraduates.

As reported in Standard 4, most faculty (with the exception of those with shared duties in administration or who have course releases for various reasons) teach a full load of at least 9 credit hours or 12 contact hours (2 to 3 courses per semester depending on whether the course has an associated laboratory). The department is allocated an administrative secretary (currently an unfilled position) and has some support provided by the research operations manager from the Chemistry and Physics Department for lab materials, safety, and waste management issues (see Appendix for Standard 7).

Based on the complexity of our department, we are likely understaffed in faculty. As the final Appendices for Standard 7 show, of the eleven departments in Arts & Sciences, we have the third greatest number of majors (being one of only three departments with more than 100 junior/senior majors), are one of six departments with a Masters program and are the third largest, yet we have 1.5 fewer faculty on average versus the rest of the college. Furthermore, we average 1 faculty member to every 10.3 students, far above the college-wide average of 1:7.5. While we do not play as large a role in the Liberal Studies program in terms of course offerings and sections offered, our lab sections constitute a tremendous time, materials, and faculty/graduate teaching assistant commitment that is not reflected in these data. In addition, our service courses in Anatomy and Physiology demand the same commitment. Only two other departments have a greater student load per faculty member (Communication and Political Science and Public Affairs). When looking at data including all majors (freshman to senior), Biology has the most majors of all departments and programs, with over 15% of all Arts & Sciences majors in our B.S. degree program. What these numbers mean to Biology is that our average faculty advisee load is larger, our course offerings proportionally smaller, and faculty time able to be committed to mentoring student researchers is lower than most of our peer departments. Taken with the dwindling budgetary resources of the last year and the demand for larger class sizes, we find ourselves in a predicament of having to increase class sizes and reduce instructional efficiency (e.g., higher grading load per class and limited opportunities for discussions, especially in our upper level courses). We hope that this trend of larger class sizes is a short-term one and that we will be able to hire additional faculty to bring us into the range of the rest of the college.

Biology Undergraduate Program Review

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