Mission, Vision and Plan: The Undergraduate Program
Prepared by Kerry S. Kilburn, Ph.D.
With feedback and comments by Drs. Deborah Waller and Douglas Mills

Contents:
- Executive Summary: pp. 1-3
- Detailed Analysis: pp. 4-21
- Conclusions: p. 21
- Supplementary Documents: pp. 22-25

Executive Summary
This report presents the results of an analysis of our undergraduate curriculum and services. The detailed analysis looks at 6 areas (the introductory courses, the core courses, upper-division electives, the capstone course, internships and undergraduate research, and advising) and addresses, in each area, where we are now, the challenges we currently face, where we would like to be, and both short- and long-term strategies for getting there. Not unexpectedly, a number of common themes emerged. These are presented in brief in the executive summary and addressed individually, along with additional findings, in the detailed analysis that follows.

Where We Are Now
Our department currently offers a well-structured curriculum that provides a broad and current introduction to the discipline; strong foundations in each of the major subdisciplines; a range of elective offerings that help prepare students for a variety of post-baccalaureate options; and opportunities for students to earn academic credit for internships and research experiences. Beginning in the Fall, 2009 semester, students will develop an understanding of the history, philosophy, ethics and practice of science throughout the curriculum, and will become increasingly sophisticated at finding, analyzing, and interpreting the primary technical literature. A capstone course requires students to put all of their skills to work as they conduct a faculty-sponsored literature review on a topic of their choice and present their results both orally and in writing.

Our advising services now emphasize one-on-one interactions with students, often multiple times each semester. This allows advisors to identify academic problems and issues early in a student's career; help students match their curricula to their short- and long-term goals; help students identify co- and extra-curricular opportunities that will help them achieve their goals; and steer students toward appropriate campus resources as needed. We currently have sufficient advising staff to provide specialized advising services to incoming freshmen, new transfer students, and students intending careers in the allied-health professions. We are also able to work directly with a COS liaison with the Career Management Center to integrate advising and internship services.
Our Major Challenges

The major challenges we currently face are critical and interrelated. First, a lack of resources and infrastructure in all of our teaching labs – especially our introductory labs – prevents us from offering students the opportunities they need to learn modern investigative techniques in the context of meaningful, inquiry-driven lab projects. In a very real sense, we are increasingly unable to teach modern biology as it should be taught. Second, lack of institutional support for non-tenured teaching faculty reduces opportunities to improve course design, pedagogy, student learning, and retention.

The same lack of resources that limits our teaching efforts has led to a third challenge with impacts across both undergraduate and graduate programs. That challenge is, of course, the dramatic loss of faculty, particularly in the ecological sciences, we have experienced. Faculty attrition over the last five years contributes to burgeoning class sizes, especially in the core courses, constrains elective offerings, and limits opportunities for in-house internships and undergraduate research.

Finally, our current academic environment is one that demands increasing faculty research productivity and fails to substantively reward excellence in teaching and service. Consequently, research faculty whose time is already constrained by conflicting demands for improved research productivity, good teaching evaluations in increasingly large classes, and increased teaching loads are naturally reluctant to carve out additional time to develop innovative teaching methods, mentor undergraduate interns and research students, or contribute to advising – activities for which institutional rewards are ephemeral at best. This places additional burdens on teaching faculty, who receive relatively little tangible acknowledgement of their efforts.

Where We Want To Be

We aspire to be a department that offers a structurally sound, modern curriculum that provides a solid foundation across the range of biological subdisciplines, adequate opportunities for in-depth specialization in selected areas, and high-quality preparation for post-baccalaureate study, whether in professional or graduate schools. Our students should be exposed to and benefit from a range of teaching methods that include, even in large classes, opportunities for small group work, discussion, problem-solving sessions, writing exercises, and more. Meaningful, inquiry-driven labs that introduce students to the full range of modern investigative and analytical techniques across the breadth of biological sciences should complement our lecture courses at all levels of instruction.

As a result of their studies, our students should be well versed in the history, philosophy, ethics, and practice of science, including the full range of skills necessary to acquire, analyze, and synthesize findings presented in the primary technical literature. And all qualified students should have the opportunity to complete in-house internships or undergraduate research projects.
Advising should remain student-centered and provide a full range of services including, but not limited to, curriculum planning, academic intervention, and individual mentoring by faculty experts in a student’s chosen field.

Teaching and research faculty alike should be materially and substantively rewarded for non-research activities that promote undergraduate success and retention. These include, but are not limited to, advising, mentoring students, providing in-house internships and research opportunities, and developing and deploying innovative teaching methods.

Strategies

Unfortunately, many of the challenges we face can only be addressed with a substantial investment of resources – resources that are currently unavailable. This is particularly true in the case of faculty attrition and the lack of adequate teaching equipment, supplies, and laboratory infrastructure. Because these specific problems have such wide-ranging effects, many of the smaller-scale challenges we face will remain unresolved for the foreseeable future.

That does not mean, however, that nothing can be done to improve our program. Some of our most immediate problems can be at least partially alleviated by, for example, coordinating the purchase and use of laboratory equipment and supplies across multiple courses and by creatively deploying GTA’s to assist in core courses. Another very simple step we can take is to cap enrollment in our core courses at 75-100 students. While none of us wish to cause problems for students trying to complete their degree programs, we must also acknowledge the increasing problems large class sizes are causing, both for faculty and for student success and retention. Relatively small investments in development opportunities for teaching faculty and focusing efforts on taking better advantage of existing opportunities and resources on campus may allow us to address some of our challenges without unduly burdening individual faculty members.

Conclusion

Department-wide efforts over the past 5 years have allowed us to create an undergraduate degree program and associated services that, even in their most minimal implementation, provide a sound introduction to the biological sciences and offer students paths to success in employment, professional school, and graduate school. Unfortunately, the problems caused by continued budget constraints and faculty attrition are bringing us very close to that point of minimal implementation. Although we can continue to provide good value for our students’ tuition dollars, we aspire to more than that. Short-term changes and creative efforts will help, but we must also be poised to make sound, strategic decisions in the long term as new resources become available. Doing so will allow us use our existing sound foundation to build a program of real excellence.
Detailed Analysis

Outline of Detailed Analysis
Questions:
1. Where are we now?
2. What are the current challenges?
3. Where do we want to go?
4. How do we get there?
   a. Short term (at or near existing resource levels)
   b. Long term (priorities for new resources)

Curriculum and Services Evaluated:
1. Introductory courses (108N/109N, 115N/116N, 250/251)
2. Core courses (291, 292, 293, 303)
3. Upper-division electives
4. Capstone course (405W)
5. Internships and undergraduate research
6. Advising

Conclusions

Introductory Courses (108N/109N\(^1\), 115N/116N, 250/251)

Where we are now:
All three of our introductory courses (counting each series as a single course) currently benefit from dedicated, enthusiastic instructors offering quality instruction in up-to-date content. All three courses are popular and regularly reach their enrollment limits early in the registration process. Enrollment in all courses is limited by a combination of GTA funding and space available for laboratory instruction.

Lecture instructors also coordinate labs, developing their own content and assessment methods and supervising their own GTA’s. This practice ensures that lectures and labs complement and supplement one another to the greatest degree possible and that the two course components together provide rich and coherent educational experiences for the students.

Until recently, Biology 115N/116N and Biology 250/251 were each taught by a tenured instructional faculty member while Biology 108N/109N was taught by a permanent lecturer. Currently, Biology 115N/116N is taught by a Visiting Assistant Instructor and the position is likely to be converted to another permanent lectureship.

Although only Biology 108N/109N is designated a non-majors course, both Biology 115N/116N and 250/251 serve dramatically more non-majors than majors. In Fall, 2008, for example, only 72 of 307 (23.45%) Biology 250 students were Biology majors. In the Spring, 2006, 178 of 471 (38%) students enrolled in Biology 116N were Biology majors.

\(^1\) Although Biology 108N/109N are non-majors courses, they require a substantial commitment of departmental resources and return a significant number of FTE. They are included here because they share common challenges and solutions with the other introductory courses.
Current challenges:
The challenges in all three courses fall into the same categories: antiquated laboratory infrastructure and lack of funding for lab equipment and supplies, large class sizes, and lack of resources for faculty development.

Laboratory infrastructure, equipment, and supplies. Two teaching laboratories, each large enough to seat 24 students, serve Biology 115N/116N. One is dedicated to Biology 108N/109N, one is dedicated to Biology 250/251, and one is shared between 250/251 and other classes. None of the laboratories have been renovated or upgraded since MGB was built 30 years ago. Rooms lack facilities for minimally modern pedagogy (mediation for PowerPoint and other computer applications, white boards, etc.). They also lack basic elements such as adequate refrigerators, incubators, fume hoods, tissue culture hoods, research-grade freezers, high-speed centrifuges, plant growth chambers and dedicated storage and teaching space for cadavers and other preserved specimens.

Because the department’s equipment and supply budget has declined in real dollars and a portion of dedicated lab fees must be used to pay GTA salaries, funding for lab equipment and supplies has remained stagnant or has declined. We can’t provide materials for essential inquiry-driven exercises in Mendelian and molecular genetics, plant and animal physiology, physiological ecology, and animal behavior; we lack the computing resources necessary to employ any of the excellent simulation and data analysis packages currently available. We can’t purchase new skeletons, cadavers, teaching models, and other materials, even to replace those that have been damaged.

This lack of resources means that some of our students are having better laboratory experiences in high schools, community colleges, and our sister institutions than we can provide. They are certainly not being sufficiently exposed to either the essential practical techniques of biology or to the complexities of scientific inquiry to prepare them adequately for their upper-level laboratory and field courses.

Large class size. Each of our introductory courses routinely enrolls more than 300 students per semester and the majority of these are taught in single large lecture settings. Large class sizes pose a number of critical challenges to both faculty and students.

First, most of our faculty agree that enrollments of more than about 100 students significantly constrain the instructional methods available to an instructor, especially when only one instructor is present in the classroom. Case studies, small group activities such as working on problem sets, and group discussions become prohibitively difficult. Unfortunately, these are the very strategies that have proven to be effective in engaging students and improving learning outcomes. This is especially true when any sort of quantitative methods are being taught, as evidenced by the Math department’s commitment to capping enrollment in its introductory courses. Our faculty report that it is also true when
students enter a class with a wide range of skills and backgrounds – which is definitely the case with our beginning students.

Second, the majority of faculty teaching classes of more than about 100 students routinely report that students in large classes develop a lack of accountability as they feel increasingly anonymous in the classroom. Concentration in a large lecture setting is difficult, leading students to become increasingly disengaged and apathetic (to the point of sleeping in class). Absenteeism increases and success and retention decline.

Finally, large classes are extremely time-consuming relative to smaller classes. Administrative tasks (Blackboard maintenance, handling exams and gradebooks, dealing with student e-mail) all become increasingly complex as class size increases. E-mail correspondence, in particular, can be disproportionately burdensome as faculty attempt to deal with students who have missed class, wish to make up assignments, are having problems, or who are simply looking for shortcuts to academic success. Whether instructors are trying to balance teaching with research or with other tasks, the balance becomes more difficult as class size increases.

For instructional faculty, the result is that we spend so much time on essential instruction and administration that we lack the time needed to develop new and innovative approaches to solving these challenges. For research faculty, the challenge is to balance high expectations for quality teaching against increasing demands for funding and research productivity in increasingly competitive funding markets.

**Faculty development.** Improving introductory biology instruction (in both lecture and lab) has been a major focus of pedagogical research for at least the last 15 years. Numerous conferences, short courses, workshops, and other faculty development venues are available annually and offer excellent opportunities for us to improve our own practices. Because introductory-level instructional faculty aren’t researchers, we lack opportunities to secure travel funds to attend these events. In addition, the department has never offered a systematic program of support for faculty development. This leaves our faculty struggling to reinvent wheels rather than employing proven instructional methods. Given that many of our students enroll in introductory courses underprepared for college-level work, our lack of access to faculty development amounts to yet another barrier to student success and retention.

The umbrella of faculty development also includes opportunities for instructors to expand, improve, and update their own knowledge base and skill sets – that is, we should have the opportunity to learn more about what to teach as well as how to teach. While all faculty spend time regularly upgrading their knowledge and skills, instructional faculty in introductory courses are additionally challenged because of the breadth of the material we teach. Unfortunately, the traditional vehicle for such development, the sabbatical, is unavailable to lecturers and impractical for non-research faculty who lack the grant funding necessary to support themselves while on developmental leave.
Where we want to go:

All introductory courses should be taught by faculty who are dedicated to, and passionate about, teaching these courses. Those faculty should possess up-to-date content knowledge and skills and should be competent practitioners of the modern pedagogical techniques known to increase student engagement and success. Students and faculty should be able to interact with one another and to build the one-on-one relationships that encourage students’ active participation in the learning process.

Students in our introductory courses should have access to safe, modern laboratory and outdoor facilities where they engage in inquiry-driven activities that introduce them both to specific content and skills and to the principles of scientific inquiry. These experiences will provide the foundation needed for continued development and success as students progress through the rest of the curriculum.

Strategies:

Short-term. Assuming that fiscal conditions will remain, at best, unchanged for the next few years, the following may help us meet current challenges. Each requires a minimal additional investment of resources at worst.

1. **Coordinate lab purchases and equipment/supply sharing among courses.** We could immediately improve the quality of our lab offerings simply by making strategic purchases that could be used in two or more of the introductory courses. Both Biology 115N/116N and Biology 108N/109N labs, for example, would be greatly improved with a fairly inexpensive investment in computers, physiology and ecology equipment, and software. Biology 108N/109N shares skeletal material and anatomical models with Biology 250/251, but neither class has enough to meet both their needs.

2. **Include the need for improved teaching labs and lab space as a major consideration during planning for MGB back-fill.** Even if renovation or the addition of major equipment is impossible, additional space could expand opportunities for quality lab instruction.

3. **Reduce lecture size.** The Math department has recognized that large-enrollment lectures are compromising students’ ability to succeed and their Chair has committed to reducing lecture enrollment. Although reducing lecture size reduces FTE, it also results in better student:teacher ratios. If other departments are concerned about their students, they might help us lobby the Administration for sufficient funds to hire additional instructors (not just lab TA’s, but lecturers).

4. **Employ GTA’s in lecture.** If GTA’s were required to attend lecture, even periodically, instructors would have more flexibility in their instructional methods. With more direct supervision of student groups, for example, faculty could employ a wider array of teaching strategies, including case studies, problem sets, small group discussions, and the like. If GTA’s were used only periodically (say, once a week or once every
few weeks), the rest of their workloads could be easily adjusted in compensation. More frequent use could require reducing their lab contact hours.

5. **Dedicate resources for instructional faculty development, including (but not limited to) funds for attending conferences and short courses on lecture and laboratory instruction.** The department should seek funds from as many sources as possible (the College, the Provost’s office, etc.) to send instructional faculty to at least one conference or short course annually. The benefits of doing so range from tangible improvements in lecture and laboratory content and instruction to the less tangible benefits of becoming active in a network of colleagues working toward common goals. Examples of appropriate events include the annual meetings of the National Association of Biology Teachers (NABT) and the Association of Biology Laboratory Instructors (ABLE) and the many workshops and short courses offered by the National Center for Case Study Teaching in Science (NCCSTS). Many of these conferences and short courses are very reasonably priced.

6. **Develop creative strategies for instructional faculty to improve their content knowledge and skill sets.** The University makes provisions for faculty to sit in on one another’s courses. To facilitate this as partial compensation for lack of sabbatical leave, the Department Chair could consider adjusting work-load analyses to provide at least some alleviation of teaching and service requirements so that instructional faculty can periodically attend courses (in Biology or other ODU departments) to stay current in their teaching fields.

**Long-term.** When resources are available, priority should be given to the following:

1. **Hire one or more laboratory coordinators for the introductory courses.** Many institutions of our size, especially those that offer both majors- and non-majors courses, employ laboratory coordinators to develop laboratory exercises and to administer the labs. Their responsibilities typically include working with GTA’s as well. Freeing instructors from lab responsibilities gives them more time to develop new teaching strategies and course materials, work on securing external instructional funding, and expand their other service contributions (advising, e.g.) to the department. Hiring a single individual to coordinate multiple lab courses (especially Biology 115N/116N and Biology 108N/109N) would also facilitate economies of scale and better coordination of lab purchases (see above).

2. **Include the need for major renovation and/or replacement of teaching labs in plans for future renovation and construction.** In the long term, we simply cannot expect to teach modern Biology in antiquated facilities that lack what are increasingly considered basic facilities and equipment. Our facilities already compare unfavorably to those in more recently-built high schools and community colleges, a sad commentary.
3. **Develop the partnerships necessary to develop outdoor “living laboratories.”** Students and faculty in Biology 108N/109N, 115N/116N, and a variety of core and elective courses desperately need access to outdoor “living labs” for activities ranging from surveying biological diversity to conducting ecology experiments. We should be lobbying strongly for partnerships with ODU’s Building and Grounds department and outside agencies (the Elizabeth River Project, Audubon Society, local nurseries, etc.) to build at least one such facility on campus (TCC Chesapeake and TCC Virginia Beach are ahead of us on this).

4. **Provide the resources necessary for instructional faculty to develop competitive proposals for external instructional funding.** The idea that instructional faculty should become active in developing and submitting grant proposals for instructional funds is an old one. A key problem with the idea is that securing instructional funding is often tied to pedagogical research, a specialty few (if any) instructional faculty are familiar with. Thus, if we are serious about pursuing outside funding, we need to provide instructional faculty with the resources (time, summer stipends, travel funds for site visits and conferences, etc.) to do so properly. Collaborating with the Education Department and the Department of Institutional Research and Assessment might also improve our chances of securing funds. We will need to recognize that this is a long-term investment, in the sense that it may take several years of preparation before we have the baseline data and other elements necessary to submit competitive grant proposals.

**Core Courses (Biology 291, 292, 293, 303²)**

**Where we are now:**

Developed in 2006 and based on existing required and elective courses, the core courses provide students with a broad foundation in the major biological subdisciplines and help them build the intellectual skills necessary for the transition to upper-level coursework. New departmental policy also requires that the core courses begin to introduce students to the history, philosophy, ethics, and practice of science as well as beginning students’ introduction to the primary technical literature. Each course is taught by a faculty member with appropriate expertise, with teaching responsibility historically divided among research faculty (usually Assistant or Associate Professors) and adjunct or other non-permanent faculty. All courses are offered every semester (including summer sessions) to meet student demand and are taught as single lecture sections with no labs.

Although courses are offered every semester, demand for them is increasing, and doing so dramatically. Consequently, enrollments were increased significantly this year. Whereas we could legitimately think of each section as a mid-sized lecture, we must now recognize them as large lecture classes.

---

² Although Biology 405W is considered part of the core, it is treated separately because of its unique mission and structure.
Current challenges:

The three challenges we face in trying to maintain and improve the quality of these courses are the increasing size of lectures and a lack of faculty available to teach them.

Large lecture size. The challenges of teaching in large lectures is the same for these courses as they are for the introductory courses and won't be reiterated here, except for two points. First, as funds for part-time instructional faculty disappear, the core courses must be taught by research faculty. The time consumed in teaching large lectures is a direct loss of research time. This is especially problematic for pre-tenure and other young faculty trying to establish competitive research programs. Second, most, if not all, of the core courses include significant quantitative elements that are exceptionally difficult to address in large lecture settings (again, note the decision to cap class size in Math classes). These challenges are relatively new and will require creative efforts to address.

Lack of faculty. Faculty attrition and our inability to replace faculty who retire or leave for other positions affect many aspects of our department, including staffing of the core courses. Many of the issues are being addressed by our two faculty subgroups (Biomedical and Ecological), including the development of standard rotations of qualified faculty through the core curriculum.
Where we want to go:

The core courses should continue to be taught by full-time faculty with current expertise in the relevant disciplines. This is necessary if students are to appreciate each of the major subdisciplines of Biology as vibrant, important, growing fields of study. Students should have access to a variety of learning experiences, including large lectures, case studies, small group activities, problem-solving sessions, etc. in order to develop the skills necessary for success in upper-level coursework. They should be exposed to increasingly sophisticated discussions of scientific inquiry and ethics and should begin their introduction to the primary scientific literature.

Faculty who teach the core courses should not find themselves so consumed with administering large lecture classes that they cannot pursue their research to the level reasonably expected at our University. Nor should their annual evaluations and other reviews be affected by negative student evaluations that reflect constraints on teaching strategies rather than poor teaching.

Strategies:

Short-term.

1. Critically assess teaching rotations for equitability. Although the current fiscal situation dictates that faculty increase their teaching loads, core course assignments should not unduly burden new faculty. As long as they remain large (over 70-100 students), they should not be assigned to pre-tenure faculty without a concomitant reduction in expectations for research productivity.

2. Use GTA’s in the core courses. Reassigning a total of 2-3 GTA’s from the introductory courses to the core courses would allow more flexibility in the kinds of teaching strategies and assessments available to students. Qualified GTA’s could, for example, lead recitation sessions or less formal open problem-solving sessions; they could assist with small group activities in lecture; and they could help grade homework and other writing assignments (within reason). Developing guidelines for appropriate workloads would take creative thought, but would be well worth the effort.

3. Cap enrollment. Although it would cost us FTE and potentially affect the students’ ability to complete their required coursework on schedule, we cannot continue to expand course size while maintaining the quality instruction needed for student success and retention.

4. Develop opportunities for tutoring in quantitative skills. Faculty teaching these courses report that topics requiring quantitative skills pose the greatest challenges to our students. We should build collaborations with the Math department and the College of Sciences’
new tutorial services to provide skill-specific tutoring opportunities for our students, whether via personal tutoring or on-line services.

Long term.
1. **Build staffing the core courses into our long-term hiring strategy.** The clear long-term solution is to hire more faculty and offer 2 smaller sections of each course each semester. Although we ideally want full-time research faculty teaching these courses, a few well-qualified part-time faculty and/or permanent lecturers would be acceptable; what we don’t want is to turn the entire core over to a cadre of part-time instructors. Both the Ecology and Biomedical subgroups are developing long-term hiring goals; the need to staff these courses should be included in both plans.

**Upper-Division Electives**

**Where we are now:**
Upper-division elective courses taught by research faculty, many of whom are nationally or internationally recognized in their fields. Relatively small class sizes allow students one-on-one interactions with their instructors and to build mentoring relationships with them. The department offers a diversity of courses, especially in microbiology, immunology, botany, and marine biology. The combination of breadth and depth of offerings allows students many options; students have left our program and successfully sought employment, admission to professional schools, and entry into graduate programs.

Students are required to complete 16 hours of upper-division electives, to include 3 lab/field courses. As enrollment has grown, demand for lab/field electives has increased and at least some students are unable to take the courses best suited to their curricular goals. Courses traditionally taken by pre-health students (Microbiology and Histology, e.g.) are particularly affected, as are courses with enrollment constraints (e.g., Marine Ecology).

Although our elective offerings have historically included breadth in zoology and terrestrial ecology, faculty attrition has reduced our offerings in these areas. This has slowed, at best, what had once been a promising new emphasis area in conservation biology.

**Current challenges:**
Our two major challenges are faculty attrition and lack of infrastructure and resources for lab and field courses. Additional challenges include irregular course scheduling and lack of summer school classes, especially field/lab electives.

**Faculty attrition.** The loss of faculty over the last 10 years, and the prospect of near-term retirements, has affected our elective offerings dramatically, particularly in the ecological sciences. The problem and potential solutions are being addressed by the two faculty subgroups and need not be reiterated here.
Lack of infrastructure and resources for lab/field courses. The Ecology subgroup has addressed this problem explicitly; the same issues affect our offerings in the biomedical sciences as well. Some of the problems are identical to those outlined in the section on introductory courses, i.e., lack of modern lab facilities, equipment, and supplies. In addition, our field offerings are further constrained by lack of vehicles (boats, vans) and funds to fuel them. Additional problems are addressed by each subgroup.

Irregular course scheduling. Where we once had a reasonably consistent 2-year schedule of elective offerings, we now have an unpredictable and often incoherent selection of offerings each semester. This burdens students both in terms of general planning and in their ability to construct meaningful, achievable curricula. This issue is being addressed on the ecological side by the ecology faculty, who developed a 2-year rotation of elective courses during our recent faculty retreat.

Lack of summer school offerings. Our students increasingly use the summer sessions as a “third semester”. While we consistently offer introductory courses and most, if not all, of our core courses, the availability of upper-division electives, especially lab and field courses, is much less predictable. Often, the only three lab/field courses available are Field Botany (a 200-level course that will soon not be accepted for upper-level credit), Entomology, and Microbiology.

Where we want to go:
Students should have access to a range of modern upper-division elective courses that will build their knowledge and skills, deepen their understanding of their chosen areas of study, challenge their understanding of scientific inquiry and ethics, and increase their comfort with acquiring and synthesizing information from the primary technical literature. They should be taught by research faculty with appropriate expertise and should have the opportunity to develop mentoring relationships with those faculty. Elective offerings should be carefully chosen and strategically scheduled to allow students to construct and execute curricula that match their goals.

Upper-division electives should include meaningful, challenging, modern lab and field experiences that, to the extent possible, expose students to real-world practices in real-world settings. Those practices should include, but aren’t limited to, using modern tools and techniques to answer scientific questions.

Strategies:

Short term.
1. Critically evaluate current elective offerings and establish a balanced rotation of courses. With a limited number of faculty and increased demand for specific courses, we must evaluate the courses offered by each faculty member to ensure that the best balance of depth and breadth of offerings is achieved over a standard 2-year rotation. This must include regular lab and field offerings, as those are the courses in greatest demand. The Ecology subgroup addressed this during our faculty
 retreat and developed such a rotation; the Biomedical group should do the same.

2. Evaluate room schedules and make lab sections a priority in lab rooms. Teaching space is at a premium and we all prefer to teach in our own building. Nonetheless, courses that include labs must be given priority when scheduling our teaching lab rooms. We must also recognize that, in many courses, students need access to lab rooms outside of class time to study.

Long term.
1. Hire additional faculty. This is being addressed by the subgroups and needs no additional commentary here.
2. Build new teaching labs and renovate existing spaces.
3. Dedicate resources for purchasing needed equipment and supplies for teaching labs.
4. Explore opportunities for faculty to use summer classes as part of their regular teaching assignments. One of our current challenges is the lack of congruence between the way our students use summer school and the way the University runs summer school. If faculty had the option of spreading their teaching loads across three sessions rather than two, we would very likely see more options available during the summer sessions. If we combined this with pay-for-credit opportunities during the fall and spring semesters (i.e., offer “summer school pay”), we might achieve a better balance of courses across semesters. We would, secondarily, give faculty members more flexibility in scheduling their teaching around their prime research times. These ideas have been floated in various University committees but should now receive serious attention.

Capstone Course (405W)

Where we are now:
Our capstone course provides an opportunity for students to study a topic of their choice in depth and to demonstrate their ability to acquire, critically evaluate, and synthesize information from the primary technical literature. Students develop a standard review paper and present their findings in a professional oral presentation. The course satisfies both the upper-division writing intensive and oral communication requirements.

Each section of the course is coordinated by a single faculty member, but each student’s work is supervised by one faculty member (the faculty sponsor) with expertise in the student’s subject. All faculty are expected to sponsor students.

Current challenges:
Four persistent challenges have faced students and faculty in this course for at least a decade.
Inadequate student preparation. The majority of students enroll in the course with little or no understanding of what the primary technical literature is, much less how to acquire, evaluate and synthesize it. Most exhibit writing skills that should be simply unacceptable in senior-level college students. Quantitative and analytical skills are similarly lacking.

Uneven grading standards. Because individual faculty sponsors grade papers, concerns persist among faculty and students that some faculty award high grades for poor work while others are much more rigorous.

Uneven workload distribution. Although all faculty are expected to participate as sponsors, those duties have historically been unequally distributed. The problem arises as a consequence of several factors, including students’ unwillingness to approach faculty from whom they haven’t taken courses and faculty electing not to sponsor during particularly busy semesters because of the very real burden of time and energy required.

Dissatisfaction with course content. The course currently doesn’t meet for all of its contact hours, and a persistent sense remains among some faculty that we are missing an important opportunity to offer more to our students than what amounts to an independent study. Exactly what that additional content should be has not been fully explored.

Where we want to be:

Students should enter the course fully prepared to complete a detailed and sophisticated review of the literature on their chosen topic. They should have the written and oral communication skills needed to discuss their topics clearly, thoroughly, and accurately. Biology 405W should truly be a culminating capstone experience for our students.

Strategies:

All of the short-term strategies listed here have been approved by the faculty and are being implemented.

Short term.

1. Establish new requirements in core and elective courses to better prepare students for 405W. We recently passed the recommendation that all courses introduce scientific inquiry and ethics, the primary literature, and basic writing assignments as appropriate for the level and size of the course. By introducing these elements early and repeating them in every course with increasing sophistication, we should see better prepared students within a few years. Faculty will be responsible for reporting compliance in teaching portfolios and assessment reports.

2. Use standardized grading rubrics. New standardized grading rubrics have been prepared for both the paper and oral presentation. These clearly outline expectations for, and characteristics of, work meriting grades from A-D.

3. Coordinators work together to assign students to faculty sponsors, with the expectation that all faculty participate. At the
beginning of each semester, 405W coordinators will develop sign-up sheets based on enrollment that apportion equal numbers of students to all faculty. Faculty will be responsible for reporting compliance in annual self-reports.

**Long term.**

1. **Evaluate course content in light of new General Education requirements once those requirements are approved.** The time to address the question of whether or not to add new content is after the new General Education requirements have been approved, as we will want to be sure our students can meet those requirements as conveniently and meaningfully as possible.

**Internships and Undergraduate Research (Unstructured Courses)**

**Where we are now:**
Internships carrying academic credit have been available to students for many years; a separate course designation for undergraduate research was implemented this academic year. Improved advising services, including better coordination with the Career Management Center, have increased student awareness of these opportunities. We have seen a sharp increase in both the number of students taking advantage of internships and research opportunities and the number of students inquiring about them.

New policies and procedures are in place for monitoring unstructured courses and ensuring that students are earning appropriate credit for meaningful work. Students now receive academic credit for a wide range of experiences, including, but not limited to, shadowing medical professionals, volunteering at the Virginia Aquarium and Norfolk Zoological Park, assisting faculty in their research labs, working with Biology graduate students, participating in field work abroad, and acting as undergraduate teaching assistants in our introductory labs.

Relatively few faculty currently sponsor undergraduate research students for a variety of reasons, but several (notably Drs. Horth and Waller) have provided outstanding opportunities for a number of students. Other faculty have been able to offer very desirable in-house internships; these are increasingly sought after by our most able and ambitious students.

**Current challenges:**

The two major challenges to providing both research opportunities and in-house internships are the lack of time, resources, and institutional reward structure.

**Mentoring students requires a large investment of time.** Faculty must train students in proper lab and field techniques, orient them to the research questions under investigation, and, in the case of undergraduate research, guide students in selecting appropriate research topics, methods, analytical tools, etc. Depending on the project, students may also require direct supervision throughout. The investment of time often lasts beyond the period of the internship...
or research project, as students return to these faculty members for academic advice, letters of recommendation, etc.

**Space and funds are unavailable.** For some faculty, the chief barrier to using student interns is very simply a lack of workspace in the laboratory. Even fairly simple research projects may become prohibitively expensive if they involve modern genetic techniques or extensive travel to field sites.

**Faculty receive no institutional rewards.** In a recent meeting, an administrator suggested that a pre-tenure faculty member would be doing himself/herself a disservice by spending time with undergraduate interns and researchers that would otherwise be spent pursuing grant funding and publications. With expectations of external funding and research productivity increasing, and with those being primary criteria for advancement within the University, relatively few faculty are willing to take time away from research to mentor students in these ways.

Where we want to be:

All qualified students should have the opportunity for meaningful internships and research experiences relevant to their career or future educational goals. Faculty who provide such experiences should be tangibly rewarded for their efforts.

Strategies:

**Short term.**

1. **Develop a better ongoing relationship with the Honors College to take advantage of funding opportunities they have to offer.** The Honors College provides competitive mini-grants of up to $1000 to defray the cost of undergraduate research, but we do a poor job of advertising this opportunity to students and faculty.

2. **Assign the position of undergraduate research/in-house internship coordinator to one of the Assistant/Associate Chairs.** Such a position would facilitate the above and would allow us to track the number of students interested in in-house internship research opportunities, the number of students doing research and internships, and the faculty involved in both. Baseline information like this would help us develop long-term strategies to increase these opportunities.

3. **Encourage graduate students to explore opportunities for undergraduates to work with them as field/lab interns and/or assistants.** We have one graduate student doing this now with very good results. We must have at least some graduate students whose basic data-gathering is sufficiently straight-forward that using undergraduate assistants would provide a good return on their investment of time.

**Long term.**
1. Work with College and other administrators to develop a tangible reward structure for faculty mentoring students in either internships or research experiences.
2. Encourage faculty to develop REUs and other proposals specifically to support undergraduate research.
3. Encourage faculty to develop ongoing internship and/or research positions with their graduate students and/or in their labs for qualified undergraduates.

Advising

Where we are now:
We have made substantial changes and significant improvements in advising service, especially over the last year. We retain our traditional approach of housing primary advising services and oversight within the department, with one dedicated advisor for pre-health students and the CDA responsible for general advising, administration, and oversight. Critically for us, the creation and staffing of the College of Sciences Advising Center in MGB 236 has added three additional advisors available to our students. One advises incoming freshmen, one specializes in new transfer students, and one provides general advising. Equally importantly, the Advising Center also houses the COS liaison with the Career Management Center, allowing improved coordination of internships and practica between the department and the CMC.

With these changes, we have begun to create a broad culture of student-centered advising built around one-on-one interactions with students. We have moved far from a model of advising as course selection and scheduling; instead, we use advising sessions to discuss students’ goals; help students develop curricular plans designed to achieve those goals; help students identify and take advantage of the range of campus resources available to assist them; and to identify problems and recommend solutions as soon as they arise. A measure of our success is that many students are now attending multiple advising sessions each semester and seeing more than one advisor to take advantage of the range of expertise available among the advising staff.

Current challenges:
Our major challenges arise from the unfortunate combination of large numbers of students, few Biology faculty advisors, and the expanding role of the CDA within the department. These challenges are exacerbated by the general lack of institutional rewards for providing advising services. Fortunately, at least a few relatively simple solutions are available to solve some of these problems.

Too many students, too few advisors. We currently have around 1000 Biology majors, exclusive of freshman Biology-intended students. Even with the assistance of the COS advising staff, trying to meet the needs of so many students is an overwhelming job, especially given that both the CDA and the pre-health advisor are teaching faculty with significant teaching and service responsibilities. To be sure, some responsibility rests with students who fail to
take advantage of early advising opportunities. Even if they did, however, the numbers would still be against us.

**Expanding role of the CDA.** Although the CDA has always been involved in curriculum design, departmental policy development, and program assessment, changes in institutional culture have made all of these jobs more complex and time consuming. Catalog revisions now take place annually. Curriculum development and implementation has become an ongoing process with no clear end in sight. Curriculum design, assessment, and accreditation have become increasingly intertwined. And new assessment tools, policies, and procedures are making that process increasingly sophisticated, valuable, and time-consuming. The time allocated to the CDA for the administrative portion of his or her job is rapidly becoming insufficient to carry out these tasks as well as they should be, especially with the growing number of students he or she still must advise.

**Lack of institutional reward for advising.** Recruiting additional well-qualified faculty members willing to dedicate the time necessary to execute advising responsibilities conscientiously and well is difficult when tenured and tenure-track faculty receive virtually no institutional rewards for this service. Thus, advising responsibilities fall to a few teaching faculty who, unfortunately, also receive few tangible rewards for taking on this critical role.

---

**Where we want to be:**

Advising should remain student-centered and provide a full range of services including, but not limited to, curriculum planning, academic intervention, and individual mentoring by faculty experts in a student’s chosen field. Students should have ample opportunities to meet with faculty advisors throughout every semester to discuss issues and questions as they arise, and should have the opportunity to develop strong one-on-one relationships with their advisors and mentors. All faculty engaged in advising should be materially and substantially rewarded for taking on this critical task.

**Strategies:**

**Short term.**

1. **Assign an Assistant CDA.** This individual would be take the lead on program assessment, provide “backup” as needed on other projects, and share advising duties. This individual should be willing and able to dedicate significant time and attention to these duties.

2. **Formalize the division of labor between “general” advisors and faculty mentors.** In the broadest sense, student advising has two components: services that help students design and successfully navigate a curriculum appropriate to their goals; and mentoring by faculty experts in students’ chosen fields. We are doing a good job with the former and need to formalize the latter. We can do this very easily by ensuring that the CDA and other general advisors have the names, contact information, and office hours of all department faculty, and that faculty understand that students will be referred to them for
career/graduate school/professional school mentoring as appropriate, usually beginning in the junior year.

3. **Lobby the Administration to continue staffing the COS Advising Center at current (or higher) levels.** As far as I know, no plans exist to eliminate the center or reduce its staffing. But we can encourage and support their decision making by explicitly discussing, whenever appropriate, the benefits our students are receiving from the Center and its staff.

**Long term.**

1. **Strategies and plans for new hires should include the need to match the number of faculty advisors to the number of Biology majors.** Even the addition of an Assistant CDA will not adequately balance the availability of advisors against student numbers; our next hires should include at least one more faculty member with explicit general advising responsibilities. Additionally, the need for faculty mentors in specific areas should be considered, along with other criteria (research programs, teaching needs, etc.) when targeting new hires.

2. **Reductions in course loads and other institutional rewards should more realistically reflect the demands placed on advisors, especially those (like the CDA, pre-health advisor, and, if appointed, Assistant CDA) with significant administrative responsibilities.** Until more faculty can be hired, we are all experiencing increased workloads. As more faculty are hired, however, we need to re-evaluate the distribution of teaching and service requirements in light of a more realistic understanding of the amount and significance of the work done by our lead advisors.

3. **Advisors with administrative responsibilities (CDA, pre-health advisor, Assistant CDA if appointed) should receive summer salary commensurate with that paid to GPD’s.** The administrative responsibilities of the CDA and pre-health advisor do not end with the school year, yet they receive no pay for the work they must do over the summer. They should therefore receive at least the same pay (the same dollar amount, not an amount based on rank) as GPD’s.

**Conclusions**

Our undergraduate program and advising services have received a great deal of the department’s attention over the past five years or so, and we are continuing to reap the benefits of the changes and improvements we have made. In spite of chronic budget shortfalls and the current fiscal crisis, we still have a program that provides the resources necessary for the qualified and motivated student to succeed in acquiring an excellent baccalaureate-level education, and to use that education as a springboard to employment, professional school, or graduate school.
We do, however, face challenges that are arguably greater than any we have faced in the last decade (if not longer) and are in imminent danger of seeing the quality of our program decline significantly if those challenges are not addressed. While we can postpone some of that decline with creative short-term solutions, we will not be able to do so for long. We need a significant infusion of resources and a sound strategic plan in place to allow us to use those resources for maximum benefit. That plan must include significant attention to the full range of issues facing our program.
With the recent increase in student numbers, some of our courses (e.g. core) have grown substantially in size, to well over 100 students. Courses that are based on quantitative skills are particularly challenging to the most recent entering students. In fact, the Chair of Mathematics and Statistics is opting to cap his courses this year because of the burdensome challenges faced with students learning material in large classes, and this after additional tutoring has been well-advertised for new students.

Addressing the extra needs of these new students is imperative, but it has also become a very time-consuming task. While we clearly want all students to do well, and recognize that for some this may mean more frequent tutoring during office hours and beyond, there are additional factors that arise when courses become this large. These include a logistic increase in email questions for help, both with class material, and with issues such as individual grades, quiz, and test scores.

It appears that as class size increases, the number of students that do not attend class regularly also increases dramatically. This means more students missing more material – which is especially problematic in courses where material builds upon itself throughout the semester. This also means missed quiz/exam returns and, importantly, the discussions of the solutions to the problems on these materials.

There are now substantially more requests for individual dates for make-up exams because a large number of students are now missing exams and are also unavailable during the scheduled make up test dates. Missed material tends to demand being addressed with the instructor on a case-by-case basis. Changes in Stella Mims office mean she is addressing fewer circumstances regarding the approval of missed courses due to substantiated illness.

The new challenge that we face deals with meeting these students’ greater needs (than past cohorts) while simultaneously increasing our grant submissions, since our university also has the laudable goal of improving our research portfolio. However, since students needs must be addressed while a course is taking place, a serious concern is that this cuts substantially into quality research time.
Response: Dr. Waller

Dear Kerry,

Although larger class sizes definitely take more time and cut into research productivity, I don't think course quality or teaching quantitative skills has to suffer. In my large (sometimes 140 students) Ecology course, I introduce statistical analyses of data (either data I give them or they collect as part of the project), and then I have students break into small groups to do the analysis. I walk around and answer questions. Usually there is one statistically sophisticated student in each group who helps the others (or sometimes leads them astray). They turn in worksheets for credit. This is also how I encourage course attendance - by having "in-class assignments" (usually six per semester) that can be given at any time and that are each worth 5 points. I never give make-ups and let students drop two quizzes (out of seven) and two in-class assignments (out of six).

Therefore my answers to your questions are: 1) students can be taught quantitative skills in large lectures, 2) absenteeism can be reduced by giving pop quizzes or pop in-class assignments and 3) one-on-one attention can be achieved by interacting with students in groups during the in-class assignments. This works for me but of course it does take time to prepare and grade the assignments. Best wishes, Debbie
Response: Dr. Englbrecht

Kerry,
I have been teaching cell and genetics in parallel F08 and now.
I agree with all of Lisa’s points, except that I do not have to write grants and therefore am not affected by this additional pressure.
(1) In my last genetics exam, the questions that caused the most problems for my students were extremely simple probability calculations, e.g. mother is carrier for recessive genetic disease, father is homozyous normal, what is the probability that their child will be sick..., I was shocked that they could not figure it out, particularly because these kinds of questions were all covered in the study guide.
(2) As soon as they figure out how the exams work, at least 50% of the students don’t come to class anymore. Suggested solutions to these problem, e.g. give examples in class that are not on slides would in my experience result in bad exam averages and the need to curve. I know that some instructors give incentives for attendance, e.g. bad attendance will exclude form curve, or good attendance will help in case a student should be ‘one percent point’ away from better grade, but with classes that large, I cannot reliably assess attendance.
(3) I get a lot of e-mail requests, some of the containing 10 or more questions from the study guide. I usually encourage them to write to me, because they seem to avoid personal contact. This is time consuming, but since I do not do research at the same time, I don’t consider it to be too bad.

This semester I have very bad attendance at exams. Most students do not even bother to excuse themselves. This is annoying and I am not sure how to change this. If you play hard and do not let them take the make up they will "punish" you with a bad evaluation. Maybe it would help if core classes had a general exam policy that applies to all of them, like yours for example. The acceptance would be higher if it would be department policy. I know that some instructors don't like to have preset exam rules. However, I have a feeling that in the future, there will be a lot of team taught classes and therefore this might simplify it a little.
Response: Dr. Cooper

After reading though what I had written, I realize Lisa has done an even better job of summarizing. As far as I have seen the last 5 years, everything she has stated applies to the Genetics course, and my own experiences as well. Attendance runs at about 60% in Genetics.

My suggestion has always been, especially in the quantitative/problem-solving courses like Genetics, Evolution, Ecology etc, would be to add TA-led discussion sections.

For example, if two half-time TAs were assigned to a course, they could each run 2 or 3 one-hour discussion sections per week, where smaller groups of students can participate in Q&A and work through example problems, chalkboard style, with the TA. Also, with TAs available to help grade, we could use more creative testing and homework measures than multiple choice. Students could register for one of the discussion sections. In practice, they could attend any section, and as many as needed. This is also where HW assignments are picked up and turned in.

Students relate well to good TAs, and the hands on problem solving and further involvement in the subject material is invaluable. This system seemed to work well when I was an undergrad; ALL of our biology courses were structured this way.

It may be my perception, but I think the pre-tenure faculty may be carrying a disproportionate load of these large courses (compared to professors, especially). This is particularly worrisome, given the pressures we face with the increased research expectations from the new dean.
Response: Dr. Lobova

I agree with everything that Lisa addressed. I want to add following to that:

1) I found it absolutely impossible to cover the material in depth that I believe required for biology majors level in Evolution class of 140 students. The problems of the large class include the very uneven level of students preparedness and background knowledge, problems with concentration during the class, disengagement of students during the lectures and discussions. Students feel that it is “unfair” that they do not get a personal attention from instructor like they would in a small class. All of the above results in a low attendance, low interest in class process (indicated by many students that asleep in class), constant questions that have nothing to do with the current lecture material (such as “will it be on exam”), and questions that indicate that students level is not appropriate for this material. I found myself wasting tons of time going over and over simple subjects that were never a problem in a class of 70. But students ask the questions that clearly indicate that they miss the explanations and I have to repeat it again in class and again during the office hours, therefore spending time necessary to advance to the next level. It is much easier to get all students engaged in lectures and discussion in a smaller class which makes the learning/teaching experience much more productive and rewarding for both sides. Majority of students are horrified to speak up in front of so many other students. That result in increased emailing/office hours attendance but most students just give up on their learning if it requires extra effort and communication.

2) The testing center had problems to schedule the tests in time suitable for my syllabus in previous years with lower enrolment but it completely failed to schedule any of the tests this semester. As a result, I have to administer tests in a room totally packed with students sitting elbow to elbow. There is no possible way to control the cheating and there is no way the students can have concentration and personal space necessary for successful outcome. The results of the first test this semester are lower than in previous semesters with 70 students.

3) I do not see any other solutions to these problems but to decrease the cap or divide the class into sections.