

February 20, 2003

To: Dean Phillip R. Certain

From: Jeff Hardin and Janet Batzli, Biocore

Re: Biocore Self-Assessment

Overview and Purpose

The Biology Core Curriculum (Biocore) is an honors program devoted entirely to undergraduate teaching and learning. Our mission is to provide a solid foundation in biology and encourage students to become actively engaged in all aspects of scientific discovery. Students that choose this track are challenged throughout a sequence of 7 courses (lecture and laboratory) that integrate with and build on each other over 4 semesters. Our faculty come from across campus to plan courses and teach as a cohesive team. In the 2001 external review of the Biocore program, committee members were unanimous in their support. They acknowledged the unique nature of the program and concluded that "Biocore is the sort of program that distinguishes excellent universities from good universities". These unique qualities contributed to Biocore being awarded the 2001 Chancellor's Award for Departmental Excellence in Teaching. Although Biocore is a resource-intensive program, the 2001 program review committee was convinced that the university has a responsibility "to maintain especially challenging learning experiences for our best students and it has an obligation to provide the best preparation for those students motivated to put forth extra effort because when they succeed, the university succeeds".

We understand that the State of Wisconsin faces difficult budgetary times forcing the University to reexamine college, departmental, and programmatic spending. We also appreciate the concern and reluctance of the administration to ask programs to increase course sizes or restrict course access given the potential negative impact on quality and student learning. Thus when we were asked in fall 2002 to identify areas from which to recover budget savings, we eliminated all Biocore administrative TA positions, resulting in a permanent savings to the college of \$8,366 (FTE 0.68, corresponding to 3 % of our budget). This change brought an overload to our faculty, TAs and staff as they absorbed new administrative responsibilities, but allowed us to maintain current course access and enrollment levels. As the College seeks additional spending cuts, we have examined our program carefully and have concluded that further cuts can be accommodated only by a reduction in enrollment. Students in our research-intensive, writing-intensive courses require a great deal of interaction and feedback from faculty, staff and TAs and we find TAs are hard-pressed to keep up given the current grading workload. If we were to reduce assignments and lower expectations, we would cease to be a challenging honors program. Further cuts would force section closures, decrease student access, compromise the student's experience, and shortcut the program's mission. We provide the following review to highlight the role that Biocore staff and faculty volunteers play in the strategic plan of the University to allow for further evaluation of our program's activities.

Context

Biocore was initiated in 1967 as a challenging course sequence for motivated, ambitious students looking for a rigorous introduction to the biological sciences. Since that time Biocore has evolved into an honors biology sequence filling a unique niche and providing an alternative to the mainstream Introductory Biology sequences (Bot/Zoo 151/152 or Bot130/Zoo101). Biocore serves an important role

in L&S by providing 18 honors credits, as well as writing-intensive courses in the natural sciences. We rely on four permanent staff, 15 faculty volunteers, and 21 teaching assistants to staff and carry out 7 team-taught courses over four semesters. Admission into Biocore is competitive, requiring students to apply in the spring of their freshman year. In the fall of 2002, 163 sophomores entered their first semester lecture/lab, joining 107 juniors as they continued in the third semester lecture and laboratory courses. Biocore is distinguished from other introductory biology course sequences on campus by (1) its two-year structure, which allows courses to build on one other sequentially, (2) its high expectations of students, (3) its emphasis on the *process* of learning and discovery, and (4) high student-instructor contact. This last feature of Biocore makes it very consistent with the stated College priorities of increasing faculty contact hours and providing tight, well-established student learning communities.

Goals

In the following section, we describe the efforts of Biocore to uphold and strengthen UW-Madison's strategic plan.

Goal One: Promoting Research

Within the context of a "Research One" University, Biocore is an atypical program in that its primary mission is advancing learning through novel educational experiences. As a science program, much of the teaching and learning occurs through a research model; however, the primary goal of this research has been educational in nature.

- *Biocore Prairie*

Biocore provides opportunities for students to become actively involved in research in a 5-acre prairie restoration project first established in 1997 in an old agricultural field near the base of Picnic Point. The prairie provides our students with a living laboratory where ecological concepts can be explored through real problems. These problems include research on soils, hydrology, seedling establishment, plant community structure, herbivores, pollinators, succession, weed ecology, restoration techniques and management. Students' first exposure to the Biocore Prairie comes in the beginning of their first semester in the program, where students study, design, and implement experiments, gather data, analyze results, and communicate their findings to the next cohort of students. In addition, small groups of students have been awarded apprenticeships to study a variety of current problems in restoration ecology research.

Grants received: Evelyn Howell, Curt Caslavka, and Ann Burgess received two grants to help support this project: a Kemper Knapp Bequest Award (1998-99; \$4250) and a Teaching Enhancement Grant from the Provost's Office (1999-00; \$4,400). Janet Batzli, and Evelyn Howell received a Kemper Knapp Bequest award (2003-04; \$4950) to continue research on this site.

- *Investigations in Physiology using Real Time Computerized Data Acquisition*

In 1997, the third semester Organismal Biology staff began developing and implementing a series of laboratory units to allow students to develop experiments focusing on various aspects of plant and human physiology. For the human studies, students use a variety of sensors to detect signals (e.g. heat rate, blood pressure, respiration, muscle contraction) that are then transferred to a computer that shows their data on the screen in real time. In recent years, students have extended their studies to more in-depth independent projects providing research opportunities for Hilldale fellows. We hope to expand research opportunities for our third semester students by bridging laboratory research to field-based studies in the Biocore Prairie.

Grants received: Donata Oertel and Marcie Meyers received a grant from the Educational Research and Development Grant Program, UW-Medical School to initiate this project (\$5000, 1996-97)

- *Bioinformatics and Molecular Modeling*

Biocore's laboratory units are continually updated to keep pace with current research in genomics and information technology. In 2001, Michelle Harris from Biocore's Cellular Biology team developed a unit

that introduces students to internet research tools for molecular biology and bioinformatics, including the BLAST and Entrez databases and RasMol. In 2002, Michelle initiated a collaboration with Mike Patrick (Wisconsin Teacher Enhancement Program) and Tim Herman, (Milwaukee School of Engineering) to study student perceptions and understanding of molecular structure using kinesthetic physical models vs. virtual computer models. This study provided a proof-of-concept for a larger study currently being prepared for an ILM proposal.

- *Proposal to Assess Student Learning for Curricular Reform*

We are currently preparing a proposal for submission to the newly funded Center for the Integration of Research, Teaching, and Learning (CIRTL; P.I.: Robert Mathieu) with the mission of preparing future faculty as teaching scholars with a teaching-as-research approach. Biocore proposes a partnership with CIRTL and the Center for Biology Education whereby graduate students and postdocs would be involved in critically assessing student misconceptions and learning within the existing curriculum. These 'teaching interns' would then be involved in developing, testing, and assessing new instructional approaches, as well as disseminating results in seminars, journal clubs and professional meetings. The existing structure of Biocore as a four-semester integrated sequence focused on the process of learning and integration of new knowledge provides many opportunities for longitudinal studies.

Goal Two: Advancing Learning

In academic year 2002-03 we generated 1179 (fall) and 1001 (spring) undergraduate credits with credits/instructor (excl TA) ratios of 589.5 (fall) and 500.5 (spring).

- *Faculty*

Teaching in Biocore involves a high level of commitment to quality instruction and student learning. Our faculty not only give lectures, but also interact extensively with students, teaching assistants, and their faculty teaching partners. In addition, our faculty course chairs provide a measure of quality control and continuity as they continually review course materials, attend each lecture by their teaching partners, attend monthly course chair meetings to assure that the program is integrated and to provide input for program direction. Most of the current faculty have volunteered to teach in Biocore because they are committed to the high program ideals and they enjoy working with the highly motivated, quality students typical to Biocore.

Following many years of dedication and contribution to excellence in teaching, the Biocore faculty and staff were honored to receive the Chancellor's Award for Departmental Excellence in Teaching. Although some of the teachers that made this award possible have subsequently retired (notably Ann Burgess in June 2002, Wayne Becker in Dec. 2002, and Millard Susman in June 2002), we maintain a fully staffed course sequence with highly, qualified exceptional faculty. Several are members of the Teaching Academy (Jeff Hardin, Zoology; Irwin Goldman, Horticulture) and serve on campus-wide committees and task forces to improve undergraduate biology education (e.g., Jeff Hardin is a member of the Executive committee for the Biology major, as well as a member of the University Academic Planning Council). In addition, Jeff Hardin is coauthor of the textbook, *The World of the Cell*, 5e (Benjamin-Cummings), which is used in several semesters of Biocore, and he was involved in extensive revisions to several chapters of Campbell et al., *Biology*, 6th edition (Benjamin-Cummings), which is used all four semesters. Finally, Jeff Hardin has recently been appointed as an editor of the journal *Cell Biology Education*.

- *Teaching Assistants*

Graduate students who intend to become faculty members view Biocore as an excellent place in which to obtain teaching experience. We employ approximately 22 graduate students per year to teach discussion and laboratory sections. Because of Biocore's dedication to teaching, we provide many opportunities for

graduate students to improve their classroom skills, to become expert at evaluating student writing, to work on new or innovative teaching methods, and provide a forum for discussion about teaching as scholarship. At the beginning of each semester, a TA workshop, organized by our staff, is held to train new TAs, by providing exposure to new pedagogies and an opportunity to discuss key student misconceptions in biology that Biocore seeks to address. Because of the emphasis Biocore places on teacher training, it has been common for postdocs to apply for teaching positions in our program; the training they receive in Biocore prepares them for a career in biology in education. Several of our faculty (Wayne Becker, Marian Meyer, and Jeff Hardin) have also led or participated in summer short courses designed to train graduate students to be more effective teachers.

- *Course Innovation*

The Biocore program has had a tradition of curricular innovations, most recently with the redesign of the fourth semester capstone course, which is taught entirely in a cooperative learning, problem-based format, in which students are asked to think critically about research in the primary scientific literature. A description of the transformation of this course has been published 2002*. Although this approach requires a high level of faculty commitment, we feel it provides greater opportunities for students to think critically, and collaborate to solve challenging scientific problems. Given a small but very committed group of faculty and staff, we have been able to maintain enough flexibility to make these changes possible.

*Burgess, A. B. 2002. *Cooperative Learning: Moving from Theory to Practice in a Class of 80 Students*. *Biocene* 28:3-8.

- *Instructional Laboratory Modernization*

Over a period of three years Biocore has received two Instructional Laboratory Modernization Grants to remodel, rewire and update equipment in two outdated laboratories in Noland Hall. The remodeling replaced old laboratory benches with mobile workstations wired for computer access.

Grants received: Marcie Meyers, ILM (\$104,052, 1998-99); Ann Burgess and Curt Caslavka, ILM (\$39,000, 2001-02)

Goal Three: Accelerating Internationalization

The mission of Biocore does not currently provide formal opportunities for internationalization. However, Biocore does offer teaching opportunities for international graduate students. Current foreign TAs include individuals native to India, Poland and Taiwan.

Goal Four: Amplifying the Wisconsin Idea

- *Contributions to Campus and National Teaching and Learning Initiatives*

Biocore is recognized nationally as a model program for the teaching and learning of undergraduate biology. Ann Burgess, former Director and Distinguished Lecturer, served on the Leadership Team for the Chemistry Departments New Traditions national curriculum reform project (1994-96) and was co-leader of the Interdisciplinary Course Clusters Project. She served on the College Level One Team for the NSF-funded National Institute for Science Education (1995-00) and was one of approximately 15 biology educators invited to meet with the Bio 2010 Committee, an 11-person task force composed of National Academy members, which was charged with recommending how we should prepare the next generation of biological researchers. The report has just been published and is available at http://www.nap.edu/catalog/10497.html?onpi_newsdoc09102002.

- *Campus Natural Area*

The Biocore Prairie was initiated with approval of the Campus Natural Areas Committee in 1996. Since then it has been used by Biocore, the Landscape Architecture department, and as a venue for public education. Dr. Mara McDonald (Biocore affiliate), together with her colleagues, has established a Bird Banding Station on the site to track and monitor bird populations for long-term research. Local bird enthusiasts, including professionals in the Departments of Zoology, Wildlife Ecology and the International

Crane Foundation, meet at the Biocore Prairie on a weekly basis to learn about birds and to help with banding /research activities. In addition, we have initiated a collaboration with David Ropa at Spring Harbor Middle School. His students are attempting a prairie restoration of their own on land owned by the Madison Metropolitan School District, and we are seeking ways for them to participate in research on our site. In addition to all of these specific activities, the Biocore Prairie is accessible to runners, hikers, naturalists, and anyone else enjoying the University's Campus Natural Areas.

Goal Five: Nurturing Human Resources

Biocore relies on the voluntary participation of committed faculty whose efforts are complemented by a small but dedicated cohort of academic staff. We have sought to nurture these two main groups of personnel in several ways.

• *Regular staff and course chair meetings*

The academic staff and the Director of Biocore meet regularly to discuss specific issues related to lab and lecture courses in a given semester, to discuss pedagogical challenges, and to plan for future improvements to the course sequence. In addition, the chairs of the four lecture courses, the Director, and the Associate director meet monthly to discuss issues related to the integration of the four courses and issues that are relevant to all of the courses. Such meetings have been effective in encouraging the faculty course chairs and maintaining their high level of commitment to the program.

• *Professional development opportunities*

We encourage our academic staff to take advantage of professional development opportunities, especially during the summer. These include attending the annual Association of Biology Laboratory Educators (ABLE) conference, participation in teaching effectiveness workshops (see above), attendance at national professional scientific meetings relevant to Biocore (e.g., Janet Batzli has attended the Ecological Society national meetings), and enrollment in short courses to develop new skill relevant to the laboratory courses (e.g., Michelle Harris attended a short course at Promega and Seth McGee attended and helped to lead a short course on protein biochemistry at MATC in the summer of 2002).

• *Nomination of teaching fellows*

We have routinely nominated our best teaching assistants to be teaching fellows. Currently, Tiffany Brake (a 304 TA) is a teaching fellow, and we have nominated Brack Hale for a fellowship for 2003-04.

• *Student recommendations*

We encourage our student to solicit recommendations from our faculty and staff. Because of the high number of contact hours we have with our students over multiple semesters, we are able to write letters that go beyond a "boiler-plate" approach to provide real insight into each student. Such letters have proven very valuable to our students as they apply to graduate and professional programs.

Conclusions

Despite the fiscal challenges facing all of us, we are excited about the future of Biocore and we are convinced more than ever before of the importance of the Biology Core Curriculum to the College of Letters and Science and to the university. With new leadership in place and a dedicated team of staff and faculty, we are positioned well not only to maintain the vitality of the program, but to heighten its impact in terms of academic research, improvement of teaching, development of future teachers and current personnel, and outreach, both locally and at the national level. Such advances cannot occur without the continued financial support of the College. We urge you to maintain our funding support so that Biocore can continue to nurture our best students, thereby maintaining, as the internal review committee put so well, "especially challenging learning experiences for our best students... because when they succeed, the university succeeds".