

Biology Core Curriculum Self-Study Biocore Honors Certificate

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Summary. The Biocore program is a four-semester, integrated honors biology program that has served highly motivated students at UW Madison campus for over 50 years. The interim director, Janet Batzli, requested that the college conduct a program review in response to recent changes in program leadership. This self-study was undertaken in preparation for that review and consists of several sections. The first section considers the recommendations from the last program review, in 2001, and describes how the Biocore program responded to those recommendations. The next section provides an overview of the program as it exists today including governance and program operation, followed by an assessment of learning outcomes. The following sections include an examination of enrollment, recruitment and diversity, advising and student support, community and climate, time to degree, and post-graduation outcomes of Biocore alumni. Finally, we conclude with a brief summary of the self-study, areas of focus, achievements and ongoing challenges.

A. Responses to last program review and programmatic changes

The [Biocore 2001 program review](#) concluded that

**“Biocore is the sort of program that distinguishes
excellent universities from good universities.”**

This is the standard that Biocore faculty, staff, and students aspire to daily.

The concerns raised in 2001 were regarding the replacement of the program director and long-time faculties. There were also questions about how Biocore would maintain the standards of excellence and quality of education demonstrated by past students. With those topics in mind, the program review committee made four recommendations:

1. leadership replacement and restructuring with appointment of faculty director and hiring associate director
2. identify tools for faculty rewards and incentives to participate in Biocore
3. investigate program advocacy by the Biological Sciences’ divisional committee, BioDeans, and department chairs when hiring or when teaching assignments are being considered
4. make and communicate timely adjustments to the curriculum based on the shifting biology landscape

Although dated, these four recommendations from the 2001 review are a logical place to begin the current self-study, especially since some of the issues are recurring or persist -- in a 2020 form.

Major changes and continuing challenges since the 2001 program review

Recommendation #1- Leadership changes and restructuring: In August 2019, Biocore's faculty director, Jeff Hardin stepped down from his position initiating the current leadership change to Janet Batzli as interim director. This change in administration stimulated the request for a comprehensive program review.

As faculty director for 18 years, Jeff Hardin provided leadership and general oversight of the program, supervised the associate director, coauthored and/or was signatory on major documents; provided advocacy at the college and administrative level, responded to major administrative problems and inquiries, and received one-month temporary base adjustment in compensation. As associate director from 2002-2019, Janet Batzli provided day-to-day leadership and oversight of the program including supervising three permanent academic staff, providing budget oversight, and leading faculty recruitment efforts. Dr. Batzli has also chaired the Biocore course chairs / curriculum committee, was lead author or co-author on major program documents, provided advocacy at the level of institutional programs and advising groups, served as back-up and support for major administrative problems and inquiries, led student recruitment and learning assessment, and co-led faculty/ TA professional development efforts.

One important outcome of the self-study was to evaluate different leadership models and recommend a preferred model to the program review committee. From our experience, the faculty director model provides a perspective for peer faculty engagement, with the director leading by example in teaching, collaboration, running a research lab, and providing focused advocacy for Biocore within their home department, at the college and institutional level. Faculty engagement is further promoted through the course chairs and executive committee leadership groups; through faculty interactions with L&S Deans. A staff director model provides 100% focus on Biocore, with dedicated time for advocacy and leadership across colleges, particularly with advisors, and at the institutional (and national) level. The staff director's scholarship is focused on undergraduate biology education with engagement and leadership there feeding back to the program. The executive committee recommends and supports the staff director model, with faculty oversight and governance through the executive committee.

Recommendation #2- Faculty reward and incentive to teach in Biocore: Since the last program review, there have been many attempts to establish faculty rewards and incentives. Current consideration of this recommendation needs to consider reorientation of administration, new budgetary models, and the Credits Follow the Instructor (CFI) metrics and guidelines. All faculty who teach in Biocore currently do so on a voluntary basis, without financial incentive to them or their department beyond CFI agreements. Biocore was founded as an intercollege program and leverages faculty expertise in biology from across campus, yet funding comes from L&S only. Beyond CFI, the incentive for faculty to teach in Biocore is intellectual and intrinsic to their identity as professors. The rewards come in the form of deep engagement with bright, inquisitive, and motivated undergraduate honors biology students in the context and continuity of an integrated curriculum. There is a real sense of satisfaction among faculty to be able to teach critical thinking, scientific reasoning, research, and process of science skills in courses where students "keep us on our toes" with stimulating questions and feedback. In addition, all current faculty instructors identify their collaborative team teaching within and between courses in Biocore as part of their reward. (see [Biocore website for current faculty teaching teams](#)).

Each faculty member works in a team with two or more faculty colleagues who have diverse expertise drawn from across five colleges. These teams work together to teach the courses and frequently engage in peer mentoring and collegial exchange of ideas on a broad range of scientific and pedagogical topics. Although these faculty rewards are nonmonetary, their value to instructors is evidenced by long-time

participation in the program. Our current faculty instructors have been with us 7 to 27 years. One faculty member said

"I find it exciting and stimulating to work with colleagues to knit the course topics together, and at the same time, look to the accompanying lab class and future courses in the curriculum to anticipate what students need to know to move ahead. The opportunity to work with faculty colleagues on this is priceless to me, as is seeing the students begin to blossom".

Nevertheless, there is great pressure for individual faculty to turn their time and attention to their own departments and colleges including L&S, CALS, SMPH, and VetMed.

Within L&S, the Botany department partnered with Biocore in 2002 on a special hire of a new faculty member for whom Biocore was identified as their main teaching assignment in the letter of offer. This arrangement was modeled after Prof Emeritus Wayne Becker's (Botany) long-time teaching assignment in two Biocore courses, and offered a unique 'tool' or precedent to connect departmental teaching with Biocore. Currently, there are three L&S faculty teaching in Biocore (two from Integrative Biology and one from Landscape Architecture) with no additional rewards other than CFI.

Until 2007, CALS provided course buy-out on special request to a department for a half-time lecturer position that allowed a CALS faculty to teach in Biocore. (Note: This is similar to the level of funding currently awarded by L&S Honors Undergraduate Initiative Funding (UIF) grants that support new honors-only courses within L&S departments.) When Biocore's budget was temporarily transferred from L&S to the Institute for Biology Education (now WISCIENCE) and back to L&S under then Director Tom Sharkey, the contribution from CALS was discontinued. There are three CALS faculty teaching in Biocore currently (two from Horticulture and one from Bacteriology). Biocore receives intellectual support from the CALS Dean and from the broad range of majors offered in CALS, however the college does not provide financial support to Biocore at this time.

The MAMA system is in place in SMPH to provide modest credit to SMPH departments when their faculty teach in Biocore. Biocore maintains a vital relationship with SMPH with six faculty from SMPH departments teaching in Biocore currently, and a long history of contributions from SMPH to the program. SMPH Admissions has shared that approximately 15% of the entering MD class admitted from UW Madison are Biocore alumni. That said, SMPH leadership does not perceive teaching of undergraduates as central to SMPH's mission, and therefore, SMPH faculty teaching in Biocore is not explicitly encouraged. One faculty member from SMPH says *"the Med School doesn't provide incentive for teaching undergraduates but I think, along with many of my peers in the department, that teaching is an important activity. More than any other course that I have taught, Biocore has helped me become a better instructor by working with great colleagues that are genuinely interested in student instruction. I wish there were more opportunities like Biocore for people interested in teaching in the Medical School."* Erik Dent (Neuroscience)

Upon assignment of this self-study, L&S Deans asked Biocore faculty to reflect on the following question. The current Biocore instructional model in which many instructors contribute to the courses offered, may be unsustainable in an era where credits follow the instructor, and when recruiting enthusiastic volunteers may be difficult if their efforts do not serve their home units. How can Biocore maintain a sufficient corps of instructors to serve its curriculum? How will the program respond as the faculty profile changes, people retire, and new faculty and staff come on board?

The responses from faculty were varied and, in some cases, dependent on college and home department. Particular mitigating factors include the number and size of courses offered, and the pressure they face in filling voids in their department course offerings. For instance,

“I think the CFI model works even better for Biocore because the credits follow the instructor back to their department (Horticulture). Thus, there is no penalty for my teaching in Biocore from the CFI point of view.”
Irwin Goldman (CALS, Horticulture)

I would like support (\$) *“for my participation in Biocore which could partially fund a new project, support an undergrad, go to a meeting, or purchase a new computer.”* Steve Johnson (VetMed, Comparative Biosciences)

“My teaching in Biocore, so long as I continue my normal departmental teaching load is more of an asset than a detriment...Campus has incentive programs for recruiting minority faculty, and the recent clusters to promote cross-campus collaborations. Why not a similar program for innovative teaching programs?”
Evelyn Howell (L&S, Landscape Architecture)

Although CFI is one tool, in the future, Biocore faculty instructors may require other mechanisms to recognize or compensate them for their participation in Biocore. At this time, we have one instructional opening in Biocore 485 to teach cardiorespiratory physiology or neurophysiology. The challenge is to find an interested and available faculty member who has expertise in organismal physiology and whose teaching philosophy is compatible with Biocore. The pool of potential instructors for this position is very limited at the moment. In the last two years, Biocore has utilized STS funding to hire a part-time lecturer to fill this opening.

Recommendation #3- Program advocacy by the Biosciences divisional committee, BioDeans, and department chairs: Advocacy from BioDeans, from Schools and Colleges, and respective departments for teaching in Biocore has been a knotty problem since the advent of the program. This issue is even more salient now, since several of our long-time, dedicated faculty and staff are contemplating an exit plan. The university has few tools to incentivize participation by individual faculty or departmental partnerships other than CFI (see above).

In contemplating this issue, we recognize that Biocore holds dual identities as both a cross-college program featuring faculty expertise and perspective from across campus as well as an L&S identity in its mission and its administration. Biocore is a strong science and liberal arts program with broad applicability to biological sciences across colleges but is structured as a small HIP Honors program. It seems that Biocore has sometimes ‘slipped through the cracks’ of visibility and attention by both the campus and the colleges for faculty recruitment, advising, and advocacy. We believe that advocacy by BioDeans and department chairs for Biocore would bring additional benefits to campus and L&S by inspiring cross college partnerships and innovation. We welcome greater visibility from leadership from across campus to meet students’ interests/needs and to attract faculty.

Faculty are asking for attention to this issue, saying:

“I think Biocore needs to be promoted and recognized by Deans/Provost/Chancellor to be the premier Biology Honors program on campus; that Biocore should be the program that students take if they want honors in biology. Then the same Deans need to promote the fact that faculty in their college are teaching in Biocore.” Shelby O’Connor (SMPH, Pathology)

“Why, in a time where the University is pushing innovative and collaborative teaching, are the rules of the university structured to de-incentivize collaborative teaching? Shouldn’t our administrators be working on making it easier rather than harder to run courses like Biocore?” Bill Bement (L&S, Integrative Biology)

“Is there a way for faculty to get special or additional recognition (within or beyond CFI) by their departments and/or colleges for teaching honors/HIP courses?” Michelle Harris (L&S, Biocore)

“I would hope that it is possible to influence the attitudes of those in power so that they will begin to value more the importance of providing outstanding education to the undergraduates in this university and the important role faculty from their respective schools/ colleges are playing in this process. Perhaps there could be discussions about how to better compensate a faculty member’s department/school for his/her time teaching in Biocore.” Anne Griep (SMPH, Cell and Regenerative Biology) “

“To me, Biocore should be the preferred route for students considering honors in bioscience.” Jeff Hardin (L&S, Integrative Biology)

*See full responses here https://docs.google.com/document/d/13UgCaxB01Vy9nwd_leR5gAsPj2reG3CG-rxz116_dhl/edit

Despite the differences in opinion on appropriate mechanisms, faculty feel strongly that Biocore is worth advocating for given its unique qualities and high impact on student learning outcomes and faculty development. We would like to encourage conversation on this recommendation from the 2001 review as part of the 2020 program review.

Recommendation #4 Make and communicate informed and timely adjustments to curriculum and course structure to meet needs of changing biology education landscape: Many changes and timely adjustments have been made since the 2001 review. All of these programmatic elements will be described in more detail in the self-study.

In short, Biocore’s four lecture courses have been continuously updated. Course topics reflect advances made in numerous scientific disciplines and are communicated by faculty with active research programs. Course structure has increasingly incorporated active and collaborative learning pedagogy including new flipped and active learning lecture course components aligned with programmatic and [UW Essential Learning Outcomes](#), and with the national call for [Vision and Change in Undergraduate Biology Education](#) (AAAS, 2011). Biocore’s three laboratory courses are research and writing intensive and have been continuously updated to hone the focus on the process of science. Learning outcomes are consistent with Course-based Undergraduate Research Experiences (CURES) ([Corwin et al. 2015](#)). The labs are further integrated with a scaffolded three-semester learning progression that includes both writing and statistics-across-the-curriculum components. As the curriculum is updated, the course chairs in both lecture and lab courses discuss alignment with program learning outcomes and make revisions inspired by emerging concepts /competencies and the changing needs of students. Adjustments are then reflected and communicated on the program curriculum map found in the [Biocore Honors Certificate Assessment Plan](#) filed with the Provost’s Office. Biocore program and individual course descriptions with learning outcomes are communicated through the Guide and the Biocore program website.

Biocore curriculum innovations have been stimulated by scholarly research on effective instruction and reflect the creative mindset of Biocore staff and faculty. Instructional academic staff are education research scholars and serve as PIs and co-PIs on institutional and federally funded research projects

partnering with faculty at UW Madison and nationally. For instance, Margaret Franzen (PI) from Milwaukee School of Engineering partnered with Biocore's Michelle Harris (Co-PI) to investigate the efficacy of using physical, molecular models in our Biocore curriculum (NSF DUE 13-23414). Ellen Damschen (PI) from Integrative Biology is partnering with Janet Batzli (Co-PI) to investigate how students' grapple with uncertainty in science through study of climate change (NSF DEB 17-512). Seth McGee (Biocore staff) worked with the Mobile Learning Incubator group to develop a prairie plant identification mobile app and, through student user testing at the Biocore Prairie, found improved efficiency and accuracy in plant identification. Other past projects include assessment of persistent misconceptions in genetics across a multi-semester curriculum, statistics-across-the-curriculum learning outcomes, and 'making time for active learning'- the impact of flipped classroom pedagogy. Biocore regularly hosts postdoctoral teaching fellows who do education research and further their professional development in teaching. Biocore welcomes graduate students from the Delta program to engage in action research which often seeds ideas for larger scale education research projects. Curriculum changes are further refined and evaluated in Biocore courses, and then disseminated through professional meetings and publications (see full list of [Biocore publications and products](#)). Furthermore, Biocore has served a unique role on campus in ecological education with the creation of the 12-acre [Biocore Prairie](#) restoration in partnership with the Lakeshore Nature Preserve. Under the direction and management of Biocore staff, the Biocore Prairie has matured as an outdoor classroom and living laboratory for ecology teaching and research in Biocore 381, 382, and 486. The prairie serves courses and research labs across campus, and the Madison community at large as a destination for teaching, research, learning and enjoyment. Each fall, the new Biocore cohort is welcomed to the learning community with their first class meeting at Biocore Prairie –an appropriate foundation for their personal and scholarly growth over the following four semesters.

As an incubator for curriculum innovation, Biocore is the subject of a recent dissertation by Dr. Dennis Lee (Clemson University, Engineering and Science Education, PhD 2020) who investigated Biocore students' development and understanding of 'how we know what we know' in science. Dr. Lee's findings from in-depth clinical interviews and classroom observations indicate that Biocore lab students generate cognitive and metacognitive frameworks for high-level scientific reasoning. In particular, laboratory feedback presentations and other social forums of peer review give students opportunities to give and receive feedback on scientific questions, rationale, experiments, data, and conclusions. This exchange of ideas creates an authentic context where scientific knowledge is debated and created—unusual and rare to find at the undergraduate level. Furthermore, Biocore's educational practices, outcomes, and curriculum were examined and highlighted in the 2016 book *Beyond the Skills Gap* by Matthew T. Hora, director of the Center for Research on College-Workforce Transitions. Hora and his colleagues Benbow and Oleson examined the classroom structure, curriculum, and outcomes emphasized in Biocore – particularly technical knowledge, teamwork, communication, and science reasoning, and found they are precisely those 'habits of mind' and integrative knowledge that are required of 21st century students in the workplace. Biocore alumni agree with these findings saying

"Biocore taught me a lot about both science and how to think in the real world. Even though I am not working in the science field right now I still use Biocore thinking every day. It helped me learn how to explain concepts to people who may not have the same understanding as you do which has been extremely beneficial in working as a (K12) teacher."

Since the last review, Biocore initiated seven co-curricular, experiential learning opportunities for students that are important to introduce here with further description later in the self-study:

1. [Biocore Peer Advisors](#)- current and former Biocore students trained as peer advisors who serve as a bridge for prospective students.
2. [Biocore Outreach Ambassadors](#)- extend Biocore ways of knowing and learning outcomes to K12 classrooms and science enrichment programs in rural schools.
3. [Biocore Peer Mentors](#)- Peer mentors, in their second year of Biocore (juniors) and trained through Biocore 401 peer mentor seminar, facilitate learning of the first-year cohort (sophomores) by leading small (8-10) voluntary study groups in coordination (but separate from) Biocore 381 and 383.
4. **Board of Directors for each Biocore course** - The BOD is a group of 5-6 students taking the course who serve as liaisons between instructors and students, and help with fine-grain course adjustments during the semester.
5. **Undergraduate TAs in Biocore lab courses**- uTAs support students in their research and writing, and help graduate TAs as they navigate through the Biocore lab courses.
6. **Biocore Prairie internships**- Interns do conservation stewardship and restoration ecology to manage and maintain the [Biocore Prairie](#).
7. **Undergraduate research**- Students do independent research projects (Biocore 699) stimulated by one of their Biocore lab courses and typically focused on prairie ecology, plant genetics, yeast biology, or animal physiology. (see [student research project abstracts](#)).

These co-curricular opportunities are not required, yet provide opportunities to expand student learning and application of Biocore learning outcomes back to Biocore and out to the broader community. Of the students who completed the program in 2019, 92% were involved in at least one co-curricular opportunity and 60% participated in two or more. These co-curricular activities are not simply additional experiences but rather the HIP 'special sauce' that binds the program together and further ignites students' intellectual growth within a rich network that reaches far beyond the boundaries of the program.

B. Overview of the Program

Biocore is an honors program and learning community devoted entirely to undergraduate biology education.

The Biocore program provides a framework for students to develop a solid foundation in biological sciences through active engagement with faculty, staff and each other as they explore all aspects of scientific discovery. Biocore embodies the Wisconsin Experience and demonstrates the benefits of high-impact practices on student learning. The curriculum has four emphases: 1.) integrative learning, 2.) research, 3.) communication, and 4.) group learning and further supports co-curricular experiences for highly motivated honors students. Biocore fulfills a unique niche by providing an integrated, introductory-to-intermediate honors track in biology as compared to the typical introductory biology sequences (Biology 151/152-3, or Zoo101/102 & Botn130). Biocore fulfills an important role in college and undergraduate biological science major requirements by offering 18 honors credits, fulfilling introductory biology (commensurate to 151/152-3), upper level genetics and physiology (commensurate with Genetics 466 and Physiology 335/ 435), upper division lab requirements for most majors, and communications B requirements.

No faculty are assigned to the Biocore program. Biocore relies on four permanent academic staff, 14 faculty volunteer instructors, and 18-20 teaching assistants to carry out seven team-taught courses over four semesters. Along with the 'core' curriculum, the program offers several additional courses to support

its central mission including Peer Mentor Training (Biocore 401- 1 cr), undergraduate research (Biocore 699- credit varies), and a new freshman course titled Becoming a Scientist: Doing Biology Research (offered in F2019 as FIG InterL&S101, *proposed* Biocore 181- 2cr H offered F2020 *currently under review*). Biocore courses are taught by teaching teams with tiered level of science expertise led by faculty or PhD level academic staff instructors, graduate TAs, undergraduate peer mentors and uTAs; all supported by a full-time lab manager. This type of collaborative team approach to teaching promotes open discussion, feedback, and an agile curriculum where students are strongly supported and changes can be implemented rapidly.

Admission into the program is by application. Students typically apply in the spring of their freshman year upon completion of chemistry (103/104 or 109) and math (217 or 221) prerequisites, generally with a 'B' grade or better.

Students take the four lecture 'core' courses (381, 383, 485, 587) in sequence. Two of the three lab courses (382, 384, 486) are required for the certificate and are generally taken in sequence, concurrently with the complementary lecture course, but can be taken out of sequence.

Fall Semester	Spring Semester
Biocore 381- Evolution, Ecology & Genetics (3cr) H *	Biocore 383- Cellular Biology (3 cr) H
Biocore 382- Evolution, Ecology & Genetics lab (2 cr) H*	Biocore 384- Cellular Biology lab (2 cr) H*
Biocore 485- Principles of Physiology (3 cr) H	Biocore 587- Biological Interactions (3 cr) H
Biocore 486- Principles of Physiology lab (2 cr) H*	

*Communications B and/or writing intensive

Biocore begins in the fall, with students moving together in a cohort through the sequence. Two cohorts are enrolled in the program at any one time. Each course is led by a course chair who coordinates course teams of typically three faculty members who teach roughly five weeks each within a 15-week lecture course. The sequence begins with an overview of ecology, transmission genetics, and evolution in Biocore 381, moves to cell and molecular biology in Biocore 383, with emphasis on biochemistry, bioenergetics, molecular genetics, and cell signaling, and then continues with animal and plant physiology in Biocore 485, where students apply physics, chemistry, and math to organismal and cellular physiological systems. The courses are integrated and build on each other from introductory to intermediate to the final advanced capstone course, Biocore 587, where students synthesize concepts and research skills through study of primary research literature on a wide range of topics including the genetics of colon cancer, mitotic spindle assembly, impact of antibiotics on the microbial ecology of the gut, and vaccine development against human papillomavirus. The laboratory courses (382, 384, 486) focus on process of science skills (intellectual and technical skills), and challenge students to develop their own independent research projects, with concepts and skills drawn heavily from lecture courses as well as chemistry, statistics, and science communication. Students learn statistical concepts and reasoning, and run statistical tests using RStudio all supported by the Biocore Statistics Primer. The Biocore Writing Manual guides students' construction of scientific research proposals, posters, final papers, and oral presentations with expectations laid out consistently in thorough rubrics. Labs are taught by the same two PhD level academic staff supported by a full-time lab manager over three semesters, providing continuity and high standards for continuous intellectual development of students.

Learning Community: Given the high instructor/ student ratio, faculty, staff, TAs, and students have the privilege of getting to know each other well. All students are recognized by their instructors on a first name basis and have ample opportunity to discuss topics, ask questions, and to form intellectual and mentor relationships. Through frequent contact between courses, our instructors have the capacity to gauge how students are progressing. The learning community first forms in the beginning of Biocore 382 lab with group research projects in the Biocore Prairie, and in Biocore 381 through peer mentored study groups. Each fall, 10-20 peer mentors lead voluntary study groups for 75% of first-year Biocore students enrolled in 381 and 383. Given the focus on group work, peers quickly learn to support each other and study together, with guidance at first by peer mentors and then on their own, to cultivate a productive learning community. Students further invest in the learning community by providing input on course instruction and curriculum decisions through the student Board of Directors (BOD), undergraduate TAs, and peer mentors. Together, the BOD, uTAs, and peer mentors contribute to the development of the learning community and provide guidance on curriculum decisions (directly or indirectly) from the student perspective.

Learning Outcomes of Biocore Honors certificate:

At the end of four semesters, Biocore students should be able to

1. Demonstrate advanced science reasoning and integration of biological concepts and processes- from molecules to ecosystems and different life forms
2. Demonstrate the capacity to engage in the process of science including the ability to generate novel questions, formulate hypotheses, carry out experiments, use quantitative (statistical) and biological reasoning make logical conclusions based on evidence
3. Demonstrate advanced scientific communication skills, oral and written, and the ability to translate understanding to the broader community
4. Actively engage in and practice group learning, collaboration, and teamwork within a community of academically engaged peers*
5. Demonstrate a learning mindset and intellectual curiosity for biology that transcends grades*
6. Reach for and achieve high standards in the quality of learning*
7. Articulate the value of the Biocore Honors experience*

*Consistent with Wisconsin Honors Outcomes <https://teachlearn.provost.wisc.edu/honors-programs/>

Criteria for Biocore Honors Certificate

Current certificate requirements are available through the Guide at

<https://guide.wisc.edu/undergraduate/letters-science/biology-core-curriculum/biology-core-curriculum-honors-certificate/#requirementstext>

The four-semester Biocore course sequence is developmental in nature, fulfilling introductory-to-intermediate and, in some cases, advanced coursework, Honors, and Communications Part B requirements for majors across five colleges, including the 30+ biological science majors ([comparison of introductory biology tracks for bioscience major degree](#) based on current Guide pages). Although Biocore was founded more than 50 years ago, the *Biology Core Curriculum Honors* certificate was added in 2017 to offer transcript recognition for completion of Biocore at the Honors level for students in: College of Agricultural and Life Sciences, College of Letters & Science, College of Engineering, School of Human Ecology, and School of Pharmacy. (Note: we aim to propose Biocore certificate recognition across all colleges in the future). Criteria for earning the Biocore Honors certificate is consistent with degrees offering Honors in the major, namely:

- Completion of 16 credits of Honors-only courses including all four lecture courses (Biocore 381, 383, 485, 587) and two of the three lab courses (Biocore 382, 384, and 486)
- A grade of 'B' or higher in all Biocore courses
- Cumulative graduating GPA of 3.33 or higher

Students who complete Biocore but do not fulfill the grade or GPA criteria cannot earn the certificate, yet still receive recognition of Honors coursework.

Biocore mission within the college and university: Biocore's mission is to support undergraduate students who are highly motivated to learn biology and to provide an integrated foundation of knowledge and skills applicable to any area of biological science. Biocore fits the mission of L&S and the university as a High Impact Practice, Honors, undergraduate, bioscience program. Housed in the College of Letters and Science, Biocore is administered independent of a department as a small program with its own budget, timetable listing, and administration under the L&S Deans Office. Biocore is one of the eight [Wisconsin Honors](#) programs recognized by the Provost's office serving to attract high achieving students and is active in the L&S High Impact Practice ("HIPsters") working group. Moreover, Biocore students and faculty fulfill the broader University of Wisconsin-Madison [mission](#), in which disciplines intersect, and where the learning environment cultivates students to discover, critically examine, and transmit foundational and emerging knowledge within and beyond biology in a broad and balanced academic program.

Biocore fits the L&S mission of undergraduate education and liberal arts skills and ideals. Specifically, the Biocore curriculum integrates scientific thinking, quantitative reasoning, and ways of knowing within the life and physical sciences together with communication, teamwork, and creativity. The interplay of these skills with biology is beautifully illustrated in Biocore's 3rd floor Noland Hall [mural entitled *The Observer*](#) painted by Biocore alum, Jaffna Mathiapparanum (18' Neurobiology and Psychology with Biocore).

Balanced with L&S perspective, Biocore maintains a vital and signature identity as a cross-college program featuring faculty expertise and student interest across the broad landscape of biology and undergraduate majors hosted by CALS and L&S primarily, but also Engineering, Pharmacy, and Education (Kinesiology). Currently, the most common majors sought by Biocore students include Biochemistry (16% L&S; 7% CALS) and Biology (7% L&S; 12% CALS) (Figure 1). In the last year, the new Health and Humanities certificate rivaled the Global Health certificate as the two most common among Biocore certificate candidates. The diverse student body from 5 different colleges, bring a cross-college and broad biological science feel to the program (from biology and biochemistry, to conversation biology, microbiology, biomedical engineering, and pharmacy & toxicology). Biocore students have diverse interests, career plans, and perspectives that they share given close contact over four semesters. They intermingle their networks and support each other in academic coursework, finding research labs, honors programs, student organizations, study abroad experiences, making faculty connections, and alumni contacts.

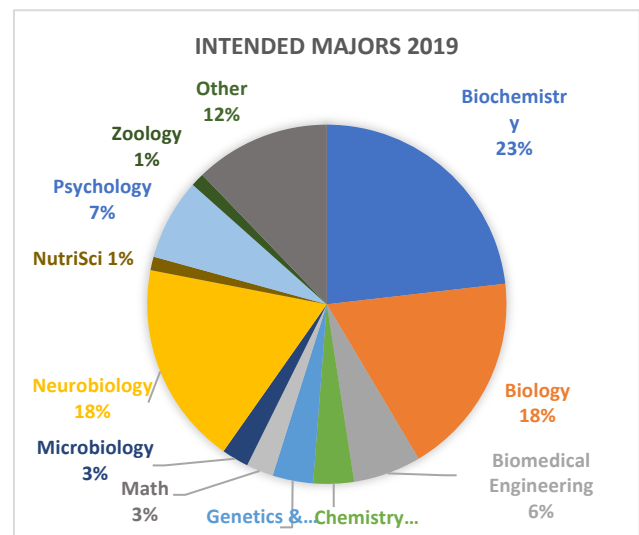


Figure 1. Biocore students intended majors from program evaluation in spring 2019. N=60.

Program Leadership and Governance: Biocore has been fortunate to have long-term, dedicated faculty who provide leadership and governance for the program in their roles as faculty director, course chairs, and executive committee members. Biocore does not have any Faculty FTE. All faculty who teach in Biocore come from other departments.

Biocore Director

Biocore has been led by either a faculty director who teaches in the program and is tenured in an L&S department or a senior academic staff member. In either case, the Biocore director has been recommended by the Biocore Executive Committee and appointed by the Dean. The director supervises permanent Biocore staff, directs operation and administration, and teaches within the program. The current leadership in Biocore is in transition, with the faculty director stepping down and the appointment of an interim academic staff director. The executive committee recommended appointing the interim director to permanent director with oversight by the executive committee in a meeting held on February 17, 2020. Further, the executive committee suggested that performance reviews of the staff director be conducted by the faculty chair of the Executive Committee, with a summary report communicated to the L&S Dean.

Executive Committee

Biocore is governed by an executive committee of at least five faculty representing L&S, CALS and SMPH, one of whom serves as chair and at least two academic staff, one of whom is the Biocore director. The committee meets at least once each semester to discuss and vote on issues associated with program and certificate issues, administrative and curriculum policy, assessment and program evaluation, faculty recruitment, enrollment, and advocacy at the departmental and institutional level. Furthermore, the executive committee reviews the performance of the Biocore director and submits an annual review to the Dean of L&S.

Course Chairs

One faculty member from each Biocore course serves voluntarily as the course chair, which is a significant responsibility beyond teaching. Course chairs have substantial experience with the course and the Biocore program more generally. They oversee the general course operation, attend all class meetings, direct the graduate TAs, mentor faculty who are new to the course, organize and coordinate their fellow faculty in course implementation, assessment, and curriculum design/ redesign. In addition, all course chairs meet once per semester as Biocore's curriculum committee to discuss course-grain curricular issues, insure integration and continuity between courses (including course openings and teaching needs), and to brainstorm new curricular innovations.

Faculty Instructors: Each faculty instructor teaches roughly 4-5 weeks of lectures, participates in the pre-semester teaching workshop with their teaching team and TAs, attends lectures taught by other faculty instructors, meets with student BOD and TAs weekly, develops learning goals for TA led discussion sections, prepares course assessments (exams/ problem sets/ in-class activities) and grades a portion of exams and problem sets. Faculty rely on Biocore program staff for course support (e.g. TA training, Canvas set up and maintenance, exam administration).

Academic Staff

Biocore has four permanent academic staff positions and one fixed term staff position. Currently, the four permanent academic staff positions are 1.) administrative program manager, 2.) laboratory manager, 3.) faculty associate instructor, 4.) interim director/ faculty associate instructor. The fixed term position is a

new administrative specialist titled High Impact Practice facilitator to provide course support, coordinate peer advisors and outreach efforts, program communication and diversity initiatives. The director conducts annual performance reviews for all five staff in accordance with human resource policies. Beginning in 2019, all reviews were implemented through the Performance Management and Development Program (PMDP).

Program Operation

Biocore staff operate as an agile team, with daily communication on administrative tasks and course support. Administration of a small program is challenged by 1.) the expanding number and diversity of administrative tasks, policy, and protocols, 2.) staff instructor time is limited and often stretched to fill instructional gaps (e.g. course chair when faculty are not available), and 3.) there is limited to no salary buffer for promotions compared to larger programs that recover funds when senior staff/ faculty retire and junior (less expensive) staff/ faculty are hired. In response to #1, Biocore's administrative program manager, who handles all HR, purchasing, budget, teaching metrics, time table, and enrollment handed off course support (i.e. CANVAS) and outreach coordination to our new administrative specialist which balanced out the workload. For #2, Biocore staff instructors (2 FTE one of whom serves as interim director) lead all three Biocore lab courses and chair one of the lecture courses. With the addition of the new freshman course (offered as a FIG in Fall 2019) we cannot maintain the high level of student attention and contact without additional instructors. For the 2019-20AY, we received funds to hire a teaching postdoc to recalibrate the teaching workload. We aim to do the same in 2020-21AY seeking UIF grant funding for honors-only courses to hire a lecturer or teaching postdoc. Regarding #3, with a lean budget that has not changed considerably in two decades, and a synchronously aging senior staff with no salary buffer, we need to maintain current funding and support from L&S administration to maintain Biocore's high quality program offerings. This year, Biocore benefited from new allocation and salary exercises that have allowed appropriate salary adjustments. However, we recognize this may reemerge as a challenge in the coming years.

C. Program Assessment and Evaluation

Biocore students engage in high impact learning that enriches their Wisconsin Experience

Biocore students achieve programmatic learning outcomes through required lecture and lab curriculum, and through the learning community's extensive co-curricular activities. Biocore submitted its Assessment Plan in January 2020 and will submit its first assessment report in Fall 2020. Despite the lack of an assessment report to refer to, this self-study stimulated in-depth evaluation of all seven Biocore Learning Outcomes using both direct and indirect assessment approaches provided in brief below.

Lecture course assessment Coarse-grained direct assessment of student performance in lecture courses is skewed to high grade distributions with very low D/F frequency. A total of ten students the 2017-18 AY and six students in 2018-19 AY earned D or F grades in any Biocore course. Final course grades are the summation of multiple types of assessments including problem sets, in-class worksheets, quizzes, projects, and exams. The exams make up 51%, 62%, 76%, and 45% of the final grade in Biocore 381, 383, 485, and 587 respectively.

Fine-grained direct assessment of student performance in lecture courses focused on evaluation of select exam questions. Exams are a mixture of short answer, graphing, data analysis, diagramming, quantitative problem solving, and multi-part essay questions with little to no multiple choice or T/F questions. To gain

perspective on how well students were achieving content and integrative learning outcomes, we examined exam questions from each course and rated them as low (know/ comprehension), medium (application/ prediction) and higher order (synthesis/evaluation) cognitive skills on a Bloom's taxonomy scale using a published rubric ([Crowe et al. 2008](#)). Once questions were 'Bloomed', we calculated overall student performance on low, medium, and higher order questions in each course as mean percent correct. We found very high (93-96% correct) achievement on lower order (knowledge/ comprehension) questions regardless of course. In Biocore 381 and 383 (introductory to intermediate courses), student performance on higher order (evaluation/ synthesis) questions ranged from 85-89% correct. As students proceed into Biocore 485 and 587 (intermediate to advanced courses) they are met with more advanced learning goals that require more background knowledge, integration, and synthesis. Still, students in those courses rise to the challenge with student performance on higher order (evaluation/ synthesis) questions ranging from 70-72% correct.

Lab course assessment Lab courses are formatted as CUREs (course-based undergraduate research experiences) where assessments are aligned with a process of science cycle including experimental design worksheets, feedback presentations to propose research projects, written research proposals or posters, data analysis and statistics worksheets and presentations, final research papers, posters or oral presentations (described in [Batzli et al. 2018](#)). There are no 'canned' labs with 'correct' answers. Students complete three research projects and process of science cycles of assessment with progressive independence and sophistication in each lab course over three semesters. Biocore lab instructors evaluate student progression in their ability to articulate novel questions, formulate hypotheses, and carry out logical experiments, and generate reasonable conclusions based on evidence using [Biocore Writing Manual](#) and [grading rubrics](#) that use published peer reviewed scientific literature as the standard. We followed one cohort's writing progression longitudinally through three semesters of labs, starting in Fall 2018 with the Biocore 382 first research proposal and ending with the Fall 2019 Biocore 486 final research paper, and found paper grades to improve from 83% to 93% on average. Biocore lab instructor, Dr. Michelle Harris, has drafted a 'Conclusion Assessment Rubric' to be piloted and validated with this sample of Biocore student papers to directly assess the scientific merit and academic quality of students' ability to articulate their conclusions based on the data generated and evidence collected from the scientific literature, as authentic to scientific practice. These results will be reported in a 2020 assessment report.

Overall program assessment Indirect assessments of program learning outcomes include annual program evaluation, the 2017 National Survey of Student Engagement (NSSE), and results from a Biocore alumni survey (done in February 2020). NSSE results for a small sample of 38 Biocore respondents indicated that they memorized less, and applied, analyzed and formed new ideas more than their counterparts in Biology, Agriculture and PreHealth. When asked on the annual program evaluation "To what extent has your Biocore experience prepared you in the following areas?", listing all seven program learning outcomes, 93-98% of students feel well prepared to very well prepared in achievement of learning outcomes. When asked which required course components of their Biocore experience were valuable in achieving the learning outcomes, they rate both lecture and lab class meetings highly, and TA-led discussion sections rated slightly lower, indicating an area for focused improvement. Students rate "being a Biocore peer mentor", "uTA", and "Biocore Outreach Ambassador" most highly for their learning and skill development of all the co-curricular opportunities offered. Over the last 4 years, students consistently rate the overall value of their learning experience in Biocore as high (3.85-4.11 out of 5), and when asked if they would choose to take Biocore over again approximately 80% say yes, 13% maybe, and 7% no. Remarkably, alumni from 2001-2019 (N=295) reported even higher value than current students

suggesting that Biocore’s value and learning outcomes are time-tested, long-lasting, and rock solid. One alumnus/a said,

“Before joining Biocore, I was losing my way a bit within UW. I attended class and had a good group of friends, but wasn’t as engaged in my coursework and lost sight of the bigger picture- that I was there to learn and not just go through the motions of passing a class. Being a part of Biocore’s close knit group of students who were highly engaged changed my perspective and challenged my thinking. Biocore helped me connect to my first job in a research lab and shaped my career.”

Lessons learned through assessment As a high-impact practice, rich honors program, the executive committee stands by Biocore’s programmatic focus on integration, research thinking, science communication, and group learning, all implemented using a student-centered teaching philosophy with high standards for excellence. Although we will continue to tweak, revise, and update the program, by all accounts, students are achieving program learning outcomes.

Through this self-study, we have uncovered a need to improve the value of TA-led lecture discussion sections. Students are required to attend discussion, yet dependent on the TA and course they find some more valuable than others. To improve, we may consider pairing our TAs with uTAs or peer mentors to ground each class meeting in a student-centered experience. In terms of updates to the curriculum, students (and alumni) have identified a few key areas that our instructors are already implementing or are in the process developing, namely expanded opportunities to learn about bioinformatics, reading and evaluating scientific papers, and further expansion of the statistics curriculum.

D. Recruiting, Admissions, and Enrollment

Biocore recruits and admits highly motivated students for small enrollment honors courses

Biocore is an application-based program that typically starts in sophomore year upon completion of general chemistry (103/104, 109, or 115) and calculus (217 or 221 or test credit). Applicants are accepted if they demonstrate achievement with a ‘B’ grade or better in prerequisite courses, with lower academic performance acceptable based on student essays and record of prior academic achievement. Students submit an online application starting in spring of their freshman year to begin their first semester of Biocore the following fall.

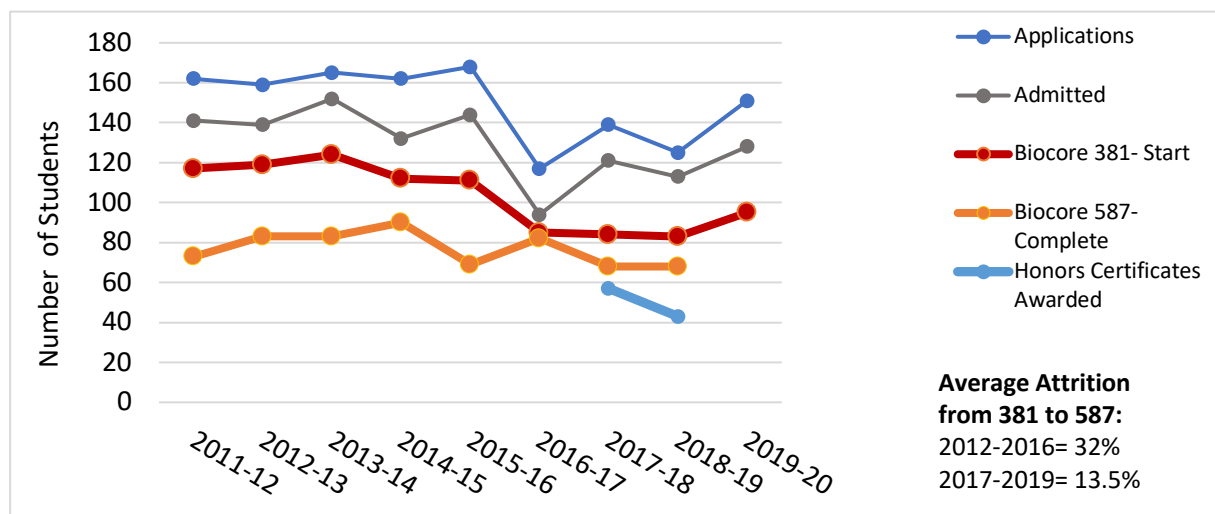


Figure 2. Biocore application, admission, enrollment, certificate awards, and attrition rates from 2011-2019.

Prior to 2016, program recruiting consisted of tabling at the Majors Fair, Chem 103 and 109 course announcements, and direct email contact with 'biology-interested' freshman who identified their interests on their UW application. This approach resulted in ~160 applicants, 140 admitted students, and 115-120 enrollees in Biocore 381 with attrition of approximately 32% over three semesters into Biocore 587.

In 2016, there was an abrupt 30% decline in enrollment to 83 students in Biocore 381 (Figure 2). At the same time, we saw attrition rates drop by more than half to 13.5%. We attribute the decreased attrition to students' desire to complete the Biocore Honors certificate which was first offered in 2017.

The shift in enrollment trends balanced with the current attrition rate stimulated rethinking of Biocore's capacity. The current program capacity is approximately 200 students total (sum of two cohorts) with 110-120 students as the enrollment cap and goal for annual recruitment which is within the 1:20 instructor/student ratio target of all Honors courses. This number is based on lab space for first year Biocore 382 sections (5 sections- 20 students each), TA time and allocation in CommB/ writing intensive courses (381, 382, 384, 486), instructional staff workload in 'core' lab courses plus the new freshman course, and attrition rate to 85-90 in Biocore 587, which is what the course was designed for (see [Burgess et al. 2002](#)). The Biocore executive committee, course instructors, and staff have reflected on the current trends, considering program capacity scenarios of status quo (200 students total – sum of two cohorts) as well as doubling or even tripling the capacity. How could Biocore operate with double the enrollment and still implement the same quality of instruction and feedback with continuity over multiple semesters? With twice or three times as many students could we maintain attention to each students' needs as individual learners and cultivate an engaged community? We know it would certainly require more instructional staff, TAs, engaged faculty, course support, and space. In addition, Biocore's expanded programming in peer mentoring, uTAs, outreach, etc... would also require additional support and attention to maintain quality and allow for continued innovation. The bottom line is in the Biocore student experience, where the learning lives in high quality feedback and personalized attention. Adding more students without dedicated instructors and course support would dilute the experience for all.

As we continue to consider enrollment with a current target goal of 110-120, we have expanded recruitment efforts (see below), developed new partnerships, co-curricular opportunities, and programming. Most notably, we have developed a new freshman course '*Becoming a Scientist: Doing Biology Research*' (20 student enrollment) to become a part of Biocore's extended academic offerings and learning community expanding Biocore's purview of its seven 'core' courses.

Recruitment The 2016 enrollment decline was surprising and stimulated a significant expansion to our recruiting approach in 2017. We focused on improving Biocore's visibility more broadly to prospective students and to the growing number of professional advisors on campus. Namely, we began

1. **Pre-SOAR communication** and application invitation to committed, high achieving students (ACT 33+ or SAT 1450+) for direct admission/ freshman start (offered to 5-10 students) or pre-admission to the program starting their sophomore year.
2. **[Biocore Peer Advisors \(PAs\)](#)**: a trained group of current Biocore students who volunteer to connect with prospective students and to be a bridge to the Biocore program. PAs do tabling at the SOAR resource fair, lead information sessions and recruitment events, consult with students by email and in person, and do advisor outreach 'house calls'.

3. [Four-year plans](#): we worked with professional advisors in the Bioscience Advising Team to create 'Biocore inclusive' sample four-year plans (updated regularly) to help students visualize how Biocore fits into an array of majors. We disseminate four-year plans at SOAR, on our website, and at information sessions which brings visibility to the majors and to Biocore.
4. **New freshman course**: we partnered with the FIG program to offer *Becoming a Scientist: Doing Biology Research* in Fall 2019, a new course for freshman to provide earlier exposure to research and to Biocore. Note: we plan to offer this course as a non-FIG, honors-only course in Fall 2020. Instead of the FIG, course buy-out will be provided by L&S Honors (UIF funding for 33.4% lecturer) to offer this honors-only course which was essential given the higher workload and demand on Biocore staff time.

We plan to continue these efforts and will explore new ways to increase Biocore's visibility within our capacity through partnerships with other high impact practice groups (e.g. Honors, FIGs, residential learning communities).

Upon initiation of this self-study, the L&S Dean asked "Are there opportunities for expansion, or for connection with new programs and/or initiatives?" We have begun initial discussions with the new CDIS leadership regarding Biocore lab courses being included in the course list to fulfill requirements for the new Data Science certificate. Shelby O'Connor and Janet Batzli have had several conversations with the Visiting International Student Program (VISP) to investigate bringing international students to UW Madison for study abroad experience on a 'Biocore VISP track'. Conversations are ongoing. We look forward to our partnership with L&S Honors in sponsorship of the newly proposed freshman honors-only course, and have reached out to CALS Honors to discuss the potential for a CALS freshman seminar. Other changes that we hope will make Biocore more accessible include a.) working with L&S administration for ways to illuminate Biocore in the Guide as an option in bioscience major four-year plans, b.) elimination of the organic chemistry requirement for Biocore which was an unnecessary and unenforceable requirement. As we remain focused on partnerships and expanded recruitment, we are starting to exhaust visibility outlets in our capacity. We welcome ideas from the program review committee, support, and advocacy for Biocore from colleges, in advising, from partner and synergistic programs, and at the institutional level.

To investigate why enrollment declined so dramatically, in 2018, Biocore requested a [study by Academic Planning and Institutional Research \(APIR\)](#). The study compared students enrolled in Biocore with those who were Biocore-eligible but not enrolled in Biocore. This study did not produce a "smoking gun" for why enrollment declined; however it did provide some very valuable counter evidence to some myths about Biocore, namely that it is a "GPA killer", a wall of credits that delays time to degree, and a waste of an "AP Bio credit coupon". The main findings indicated that 1.) Biocore students graduate with higher GPA (3.55 compared to 3.30 for non-Biocore (Biocore eligible) students), 2) there is no difference in time to degree between Biocore and non-Biocore (Biocore eligible) students, 3) participation in Biocore among students with AP Bio (Exam 4+) remains high with no apparent increase in that population taking Biology 151/152-3. The study did reveal a decrease in CALS and an increase in L&S students enrolling in Biocore at the time of the enrollment decline, yet there is no clear reason for this shift. We have met with directors of advising teams to examine qualitative changes in student needs, as well as sharing important take away messages from the APIR report.

Diversity: Students in the incoming Biocore cohorts between 2014 and 2018 report their racial and ethnic identities as 28% students of color with varying ethnicities (Figure 3), while the graduating cohorts had 25% of those same individuals. These data, though broadly reflecting the UW-Madison student body as a whole, indicate a need for work on both recruitment and retention. In the current, outgoing Biocore cohort, students report they are 53% female, 2% gender non-conforming, 14% lower income, and 9% first generation college. Again, the lower numbers here are not surprising but highlight opportunities for improvement.

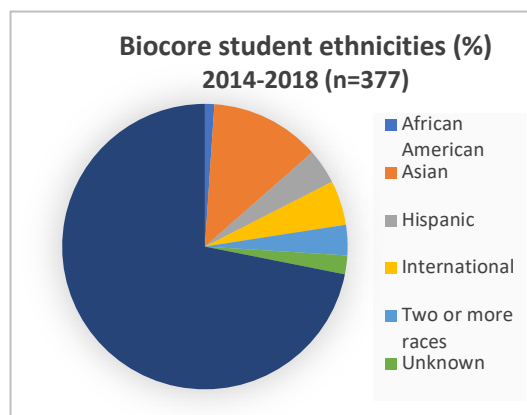


Figure 3. Biocore student racial and ethnic identities combined over five years (2014-2018).

With relatively low diversity among Biocore staff, faculty, and TAs, we are responsible for modeling, creating, and facilitating an inclusive, diverse classroom climate and work environment for all—and state this expectation clearly in an Inclusivity Statement associated with all Biocore course syllabi. The Biocore staff have been the primary initiators and points of contact for ‘diversity leadership’ including a recent hire for a newly created High Impact Practice Facilitator staff position. This individual is a first generation Pakistani-American and devout Muslim, has provided an invaluable and enriched perspective among our staff. In addition, this staff member serves as the coordinator for peer advisors and outreach ambassadors, with responsibility for keeping diversity, inclusion, and climate issues at the top of the agenda for program recruitment, student admissions; and for doing outreach and mentoring.

We aim to improve recruitment and retention among students of color and first-generation college students. In particular, with Biocore’s smaller class size—we provide special emphasis on student support, accommodations, and attention to inclusion. Diversity enhancement efforts include inclusive teaching workshops for Biocore TAs and staff each semester, the FIG (now Honors) course as a pathway for diverse student populations to learn about Biocore, staff involvement in the WISCIENCE STEM Immersion program for URM and first-generation college students, and a supportive learning community and co-curricular opportunities that foster relationships outside of class. As one example, the Biocore Outreach Ambassadors (Figure 4) work with K12 classroom teachers, students and families in rural schools around Madison. The target audience may or may not be diverse in race, ethnicity, faith, (dis)ability, sexual orientation or any other measure of diversity, yet the ambassadors themselves are diverse and bring their perspectives and the Wisconsin Idea with them.



Figure 4. Some of the 2018-2019 Biocore Outreach Ambassadors

E. Advising and Student Support

Advising and student support are integrated into the daily activities of Biocore staff

Advising There are no professional or titled advisors in Biocore. Rather, Biocore staff work closely with professional advisors to discuss student questions, interests, share curriculum updates, application and enrollment information. Biocore partners with bioscience major advisors to generate 'Biocore inclusive' four-year plans which are updated regularly and disseminated at SOAR and on the Biocore website. Biocore is part of the Bioscience Advising Team (BAT) working group, who include directors and representatives from all the bioscience majors, Center for Pre-Health Advising, Academic Advising Services (AAS-L&S), Transitional Advising and Outreach (TAOS-CALS), and Cross-College Advising Service. In addition, Biocore is part of both the L&S High Impact Practice working group (including CAE, FIGs, URS, residential learning communities) and the University Honors Committee, in which directors of all HIP and Wisconsin Honors programs meet regularly to discuss topics including advising and student support. In the last three years, Biocore has worked with advising teams and curriculum committees to generate three important [memos about commensurate coursework](#)-- for Genetics 466, Physiology 335/435, and Biology 151/152. Lastly, Biocore Peer Advisors are trained with the assistance of BAT professional advisors through an annual training session, which also provides time for reciprocal dialog between advisors and Biocore students. We aim to enrich Biocore Peer Advisor training in the future using the guiding principles and core competencies for academic advising as a framework.

The Biology Core Curriculum Honors Certificate can be found online in the [Guide](#) as a resource for students, advisors, and campus. Biocore courses are found in the Requirements pages for 25 different bioscience majors. More recently, majors have been asked to include Four-Year Plans in their Guide pages to illustrate one sample or typical set of courses a student could use to fulfill major requirements in four years. As a small, HIP honors program, Biocore may appear opaque in this instance since Biology 151/152 is considered the typical path represented in four-year plans, with Biocore represented as a footnote or not at all. Before the Guide, students often asked their advisors "which intro bio track?", with three choices laid out 1.) Biology 151/152-3, 2.) Zoo101/102 and Botn130, and 3.) Biocore. With students being guided to the Guide (as 'truth') to make decisions about majors and coursework, how can the administration clearly illuminate Biocore and Zoo101/102, Botn130 as an option when appropriate? As the Guide continues to be updated, and policy created, we would like to work with advisors, administrators, and students to identify effective ways to represent Biocore as an option in bioscience majors Guide approved Four-Year Plans.

Student Support Given the high instructor to student ratio, Biocore staff and faculty take time and invest great effort in student support in all aspects of their Biocore experience, in mentoring and career advising, and even life coaching. Biocore instructors, TAs, uTAs, peer advisors, and peer mentors are trained to support students through student-centered teaching and mentoring, helping students to develop a learning mindset and to discover their own strengths, interests, and perceived weaknesses through questions and self-discovery. Biocore instructors get to know students well through frequent one-on-one meetings, and therefore write a large number of letters of recommendations each year (total of 50-60 letters/year from Biocore staff alone) for scholarships, awards, internships, graduate and professional school programs. Course chairs meet individually with each McBurney student within the first two weeks of class each semester to clarify and adjust accommodation requests. TAs and course instructors meet individually with struggling students after each exam in lecture courses or high stakes assessment in lab. Biocore's director meets with all students that earn D/F grades in Biocore 381 or 383 to support struggling students with guidance, program/campus resources, or advise on alternative paths out of Biocore.

We have no standard mechanism to evaluate the impact of student support and advising. However, former Biocore students communicate about their personal growth, whether through Biocore Peer Advising conversations with prospective students, in personal statements and applications to graduate and professional schools, and most vividly in unsolicited thank you cards and letters.

One 2018 alumnus said,

“... your guidance and support [in Biocore] has not only made me a better student and learner, but also a better person. As cliché as that sounds, I think my time in Biocore was formative for me. I experienced a wide range of ups and downs in my time there, but in the end, I was better because of the rigor of the program. I learned to appreciate science, work with others, and to learn with passion. You all did such a wonderful job of making everyone feel like part of the family and for that I am truly grateful.”

F. Program Community and Climate

Biocore is a vibrant student learning community

The learning community in Biocore is one of its strengths, and part of the reason students are attracted to Biocore—particularly with its small size and cohort structure for developing relationships over four-semester. Yet community and climate are challenging to assess directly.

We understand that developing community and climate is a process that is modeled and facilitated at all levels in a program, starting with faculty and staff, with its importance communicated both directly and indirectly to students. The Biocore director and staff are primarily responsible for setting the tone, communicating expectations, and enacting the type of work and community environment we feel is most beneficial to learning. Faculty are recruited to teach in Biocore with expectations that they will contribute positively to their teaching team and to the learning community at large. Our community expectations of respect and inclusivity are stated in each syllabus, and practiced following team and class working agreements.

One of the learning outcomes for the program is to “actively engage in and practice group learning, collaboration, and teamwork within a community of academically engaged peers”. We have found that peer learning whether with near-peers (peer mentors, uTAs, peer advisors) or fellow classmates, requires structure, guidance, and a welcoming physical environment to foster development of community and productive team work. When students enter Biocore, they are introduced to structured group work where they are assigned to a team, and each member has responsibility, a role, and accountability to the group. Group members get to know each other by identifying their constructive and destructive group behaviors at the beginning of longer projects. Students then evaluate themselves and each other on their group development and work together using a [Group Effort Analysis rubric](#). Specifically, they are asked to evaluate their a.) ability to listen to the ideas and concerns of others, and b.) to cooperate and compromise—both of which are major components of developing a caring and comfortable climate and community for learning. At the mid-point of the semester in lab courses and in Biocore 587 lecture, instructors collate feedback and distribute comments to each student to give them time to reflect and further develop their skills as a productive team member. At the end of four-semester of group work, students rarely sit by themselves in class; they work together as colleagues, and generally feel safe, welcomed, and respected (Figure 5B). On the annual program evaluation in the last three years, 79-84% of students rated their Biocore student community and learning environment as valuable to very valuable in their learning and skill development.

With all Biocore courses meeting in the same Noland Hall lecture room and all labs and discussion sections meeting in 3rd floor Noland classrooms, students interact and connect with one another often—both within and between cohorts. Third floor Noland classrooms are fitted with key lock boxes, and students are entrusted with key codes giving them autonomy to meet, study, and organize together in a safe and comfortable common space outside of class time. Now, with the new hallway mural, Biocore has situated several couches, benches, and tables in the corridor to foster student study and corridor conversation just outside Biocore staff instructors’ offices.

In a recent survey designed to measure students’ sense of belonging, comfort and safety, in both academic and interpersonal interactions, the majority of students said they addressed other students by name, and felt comfortable posing questions, sharing ideas, and respectfully disagreeing with a classmate (Figure 5A). In a related question (Figure 5B), students report their general experience as feeling welcomed, safe, like they belong, and respected. Looking more closely, students of color and first-generation college students feel less comfortable sharing ideas and less welcome/like they belong as compared with other categories of students. Although sample size is low for these groups, this response highlights the need to support community growth. One particular goal of peer-mentored study groups is to hasten, foster, and facilitate the development of community by creating an inclusive climate for

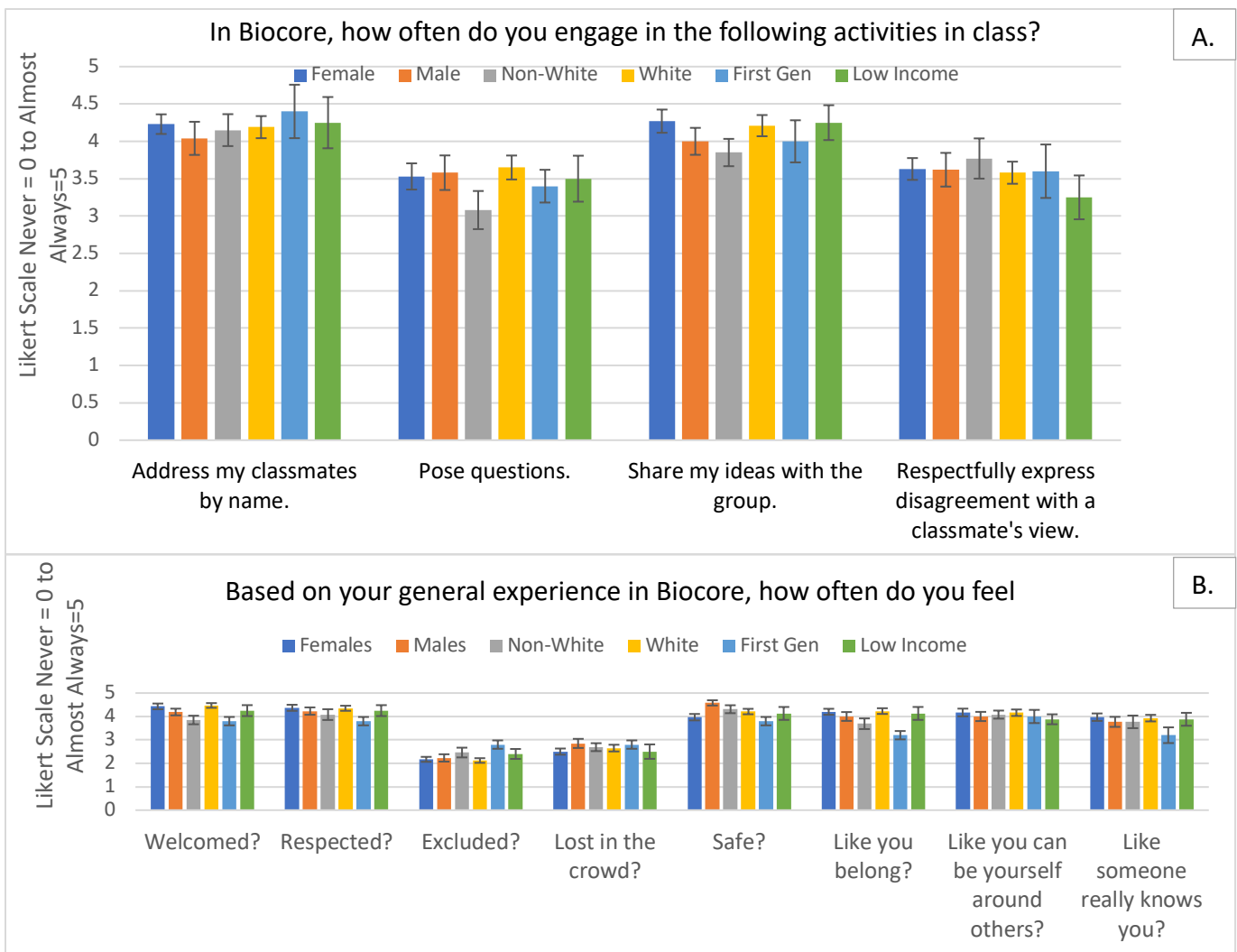


Figure 5A & B. Biocore climate and community questions from January 2020 survey of Biocore 587 students (N=71 total; with subset N=38 female, 33 male, 16 non-white, 55 white, 6 first generation college, and 10 low income).

learning. In the future, we aim to do targeted recruiting for our peer mentors to better represent perspectives of our diverse student groups to incoming students similar to the model practiced by our colleagues in the Physics Learning Center.

G. Degree Completion and Time to Degree

Biocore students graduate in less than 4 years on average.

When considering Biocore, students and advisors often wonder whether the four-semester structure of Biocore hinders students' time to degree. In the recent study by APIR investigating Biocore enrollment over five years (2011-2017), the average time to degree of graduates participating in Biocore was 3.64 to 3.73 years if they completed prerequisite courses in chemistry and math in their first or second semester, respectively. This is similar or slightly less than 3.78 years for non-Biocore (but Biocore eligible) students. Given this data, we are confident that students will not add time to degree by participating in Biocore. It is important that students are advised to complete prerequisite courses during their freshman year so they are eligible to start Biocore in the fall of their sophomore year.

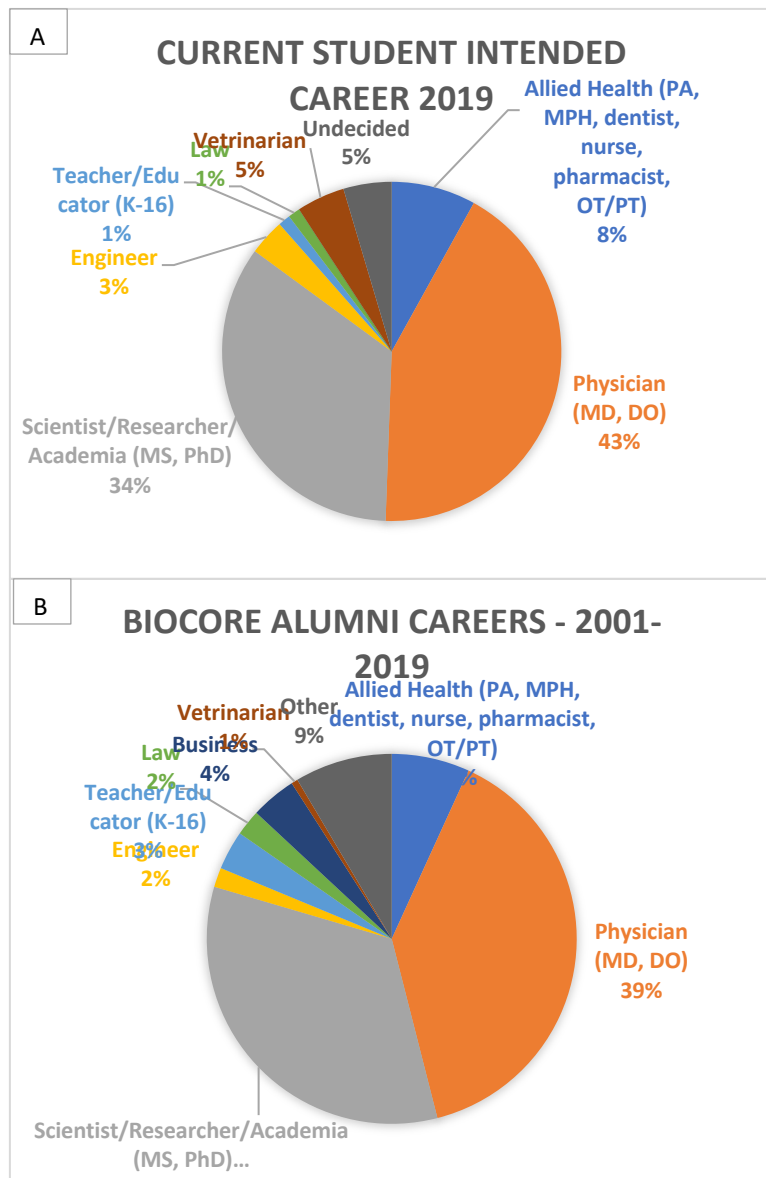
In recent years, students have been concerned that Biocore limits their choice of study abroad opportunities. It is true that complete flexibility is limited somewhat, especially if students aim to stay with their Biocore cohort all four semesters. However, study abroad is compatible with Biocore when done in the summer to allow continuity with a student's cohort, or spring of junior year to then allow completion of Biocore 587 in the spring of senior year, out of sync with a student's initial cohort. Although anecdotal, we have not heard students report that studying abroad and doing Biocore has increased time to degree.

H. Career Services and Post-Graduation Outcomes

Biocore students achieve their career goals

Biocore students have a range of intended careers with medicine and research covering two-thirds of their interests (Figure 6A). This distribution has been stable for many years. It is striking (surprising in fact!) how closely the actual careers of Biocore alumni (Figure 6B) match students intentions.

Figure 6A & B. Biocore 587 students self-reported intended career from the 2019 program evaluation (N=60) and Biocore alumni (2001-2019) self-reported actual careers (N=295).



In a survey of alumni from graduating classes 2001-2019, they highly valued the scientific reasoning, integrative thinking, research writing, teamwork, and the learning mindset they gained through their participation in Biocore (Figure 7A). They agree to strongly agree that Biocore helped prepare them for their current career, was a key part of their undergraduate experience, and positively influenced their career path (Figure 7B), with the vast majority saying that they would recommend Biocore to incoming UW-Madison students interested in biology/ STEM. Although the response rate to our email request was relatively low at 10% of alumni, we feel the signal is strong—that graduates and alumni of Biocore are achieving career goals and recognizing Biocore as a very valuable aspect of their Wisconsin Experience.

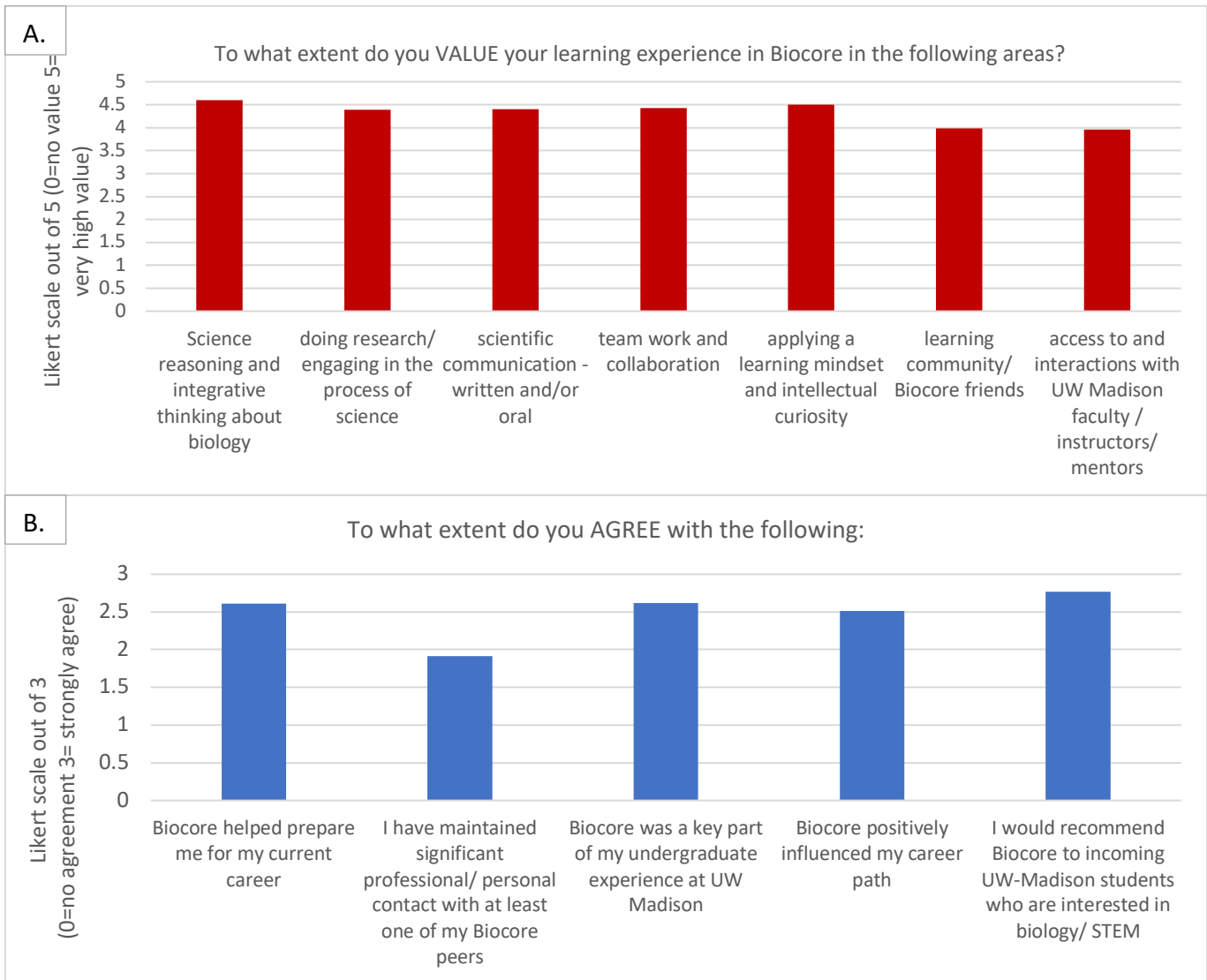


Figure 7A & B. Biocore alumni (2001-2019) responses to Feb 2020 survey on the value of their experience. N=295.

Some alumni say,

"I came into Biocore knowing the learning outcomes and goals matched with my own aspirations, however from it came friendships and networking I did not believe I could attain. Before my time in Biocore, I was overwhelmed with how large the university was. Coupled with no mentors to speak to and my mother not having experience with education in the USA – I was afraid and to the point of discomfort that didn't allow me to learn effectively. Biocore changed that, with my love for biological sciences and a learning environment that pushed me forward."

"Biocore fundamentally shaped how I think about science and the scientific process. I learned that I loved building scientific arguments for my hypotheses and explanations for my results. The skills I developed in Biocore - especially the teamwork and presentation skills - I still use today."

"The technical writing experience, the networking with other students, and the faculty to student ratio with hands on feedback combine to allow you to grow as a budding scientist. I think those aspects of the community are what I value most and what makes it special."

These quotes are only a few among the many that describe how students valued the learning mindset, skills, community, and belonging as important contributors to their career and lifelong learning.

Until recently, Biocore had no formal resources to provide students with career advice. Now there are a number of career advising services that we regularly point students to including Center for Pre-Health Advising and SuccessWorks. In the last two years, the Biocore Peer Advisors hosted an evening event with directors from SMPH Admissions (MD/MPH) to talk with current Biocore students. We support many students' applications through letters of recommendation to graduate and professional degree programs, research labs, study abroad/ scientific and cultural exchange, and internships /work in professional settings. When we asked alumni if they would be interested in connecting with Biocore undergraduates for alumni networking, the majority said yes, with 120 alumni sharing their contact information and encouragement to connect. This was an unexpected and inspiring response. We do not currently have a mechanism to pair offers with interest, but plan to consult with SuccessWorks as a starting point.

I. Overall Summary of the Self-Study and State of the Biocore Program

Biocore provides an excellent quality learning experience for students By all measures, students and alumni value the program as central to their Wisconsin Experience. Students achievement of learning outcomes is high.

Affordances and Challenges

Students are developing a learning mindset and applying their learning through scientific reasoning, research, integrative learning, communication and teamwork. These are high-level skills that take time to develop (four semesters), are bolstered by continuity of curriculum, and require consistent interaction with instructors (faculty and staff). It takes a high level of logistical support and instructor engagement to carry out the curriculum, yet the rewards of student learning are evident.

Biocore would benefit from greater visibility and advocacy to attract and sustain the next generation of Biocore students. Enrollment is lower than historic levels yet when balanced with low attrition Biocore may be defining a new capacity. When we factor in expanded programming (freshman course), active co-curricular opportunities, and staff workload, we are considering how to reframe the program as HIP-Honors, diverse, and welcoming while maintaining the same high-quality student support and learning environment.

Affordances and Challenges

With a target capacity of 110-120 students per cohort entering Biocore 381, we will be able to continue excellent educational outcomes while continuing to innovate, seek partnerships, and excel as an academic unit. We face challenges in competing for students' attention, educating advisors, and debunking myths regarding time to degree, GPA consequences, and the value of the program for career development (and lifelong learning). As a small program, we have a small voice, and perceive we are not reaching all students who might benefit. We would like advocacy from leadership, advisors and administration to advertise Biocore, and thereby, affirm its value to students as a cross-college accessible, L&S owned HIP honors biology program that will enhance students' Wisconsin Experience.

Biocore administration needs support and tools to maintain program operation, and attract and engage the next generation of Biocore faculty instructors and leaders

Faculty enjoy teaching in Biocore and have a high level of satisfaction teaching motivated students in a teaching team of engaged colleagues. They receive modest reward through CFI back to their departments.

Affordances and Challenges

Although this is enough for some, other faculty face pressure to bow out of Biocore, especially given the time commitment that a team-taught honors course demands. We look to colleges and leadership to help create additional tools beyond CFI to encourage faculty instruction in honors-level courses in general. For example, Biocore would benefit from additional resources to reward course chairs, who are essential for maintaining the caliber of teaching and innovation we have come to expect.

The Dean's final question for our self-study was "Given resource constraints, is there a way to organize program administration and operations, to make better use of limited resources?" We believe we run a very tight ship administering 22-23 credits (Biocore 381, 382, 383, 384, 485, 486, 587; Biocore 401, 699 when offered, and new proposed 181) and seven co-curricular activities with relatively small budget and no faculty FTE. All Biocore staff play multiple roles within the program and staff work cooperatively to a high degree. A high level of administrative support is one of the few perks that we offer to faculty and one that faculty value very highly. A low administrative burden is essential for retention of faculty, none of whom have an appointment in Biocore and few of whom have an appointment in L&S. On the student benefit side, we strongly believe the student return on investment in Biocore is very high as evidenced by student achievement of learning outcomes and alumni satisfaction.