Biology Major Review Committee
23 January 2012

Charge from CALS and L&S Deans

1. Does this major have a clear purpose and an appropriate intellectual coherence?
1a. What is the relationship of Biology Major to other majors?

2. How well is the current administrative structure serving the major and is there a better model we should consider?
2a. what are the resources? who controls them? who oversees changes to the curriculum?
2b. Where should the major have its administrative home? department, a department in each college, or in a cross-college entity like IBE?
2c. What should the relationship be between CALS, L&S, IBE and the Biology Major?

3. Are the students receiving sufficient and good advising?
3a. How can the major enhance faculty involvement in advising?

4. How well prepared for their future endeavors (Med school, grad school, private sector) are students who major in biology?

Biology Major 10-Year Review Executive Summary
23 January 2012

Ken Albrecht, Agronomy
Marion Greaser, Animal Science
Clark Johnson, Geoscience
Jed Sparks, Office of Undergraduate Biology, Cornell University (Director)
Don Waller, Botany
Amy Wong, Bacteriology
Brian Yandell, Horticulture and Statistics (Chair)

The Biology Major, created in 1999 as a modification of the existing School of Education Biology Major to include CALS and L&S, has become the largest major on campus, with over 1200 undergraduates currently and no sign of a plateau. The Institute for Biology Education (IBE), formed in 2004, took over administration of certain aspects of the Biology Major, particularly professional staff advising of students. The Biology Major has been a tremendous success for students, who value the broad biology theme. However, certain aspects of the major have presented challenges and frustrations for students, faculty and staff. This 10-year review addresses concerns and offers recommendations about the administrative structure and home, advising, resources, alumni relations, community connections and curriculum for the Biology Major. While some recommendations are specific, they are meant as guides for administrators, faculty and professional staff involved with the major.

To date, the Biology Major has remained an orphan, or step-child, degree program relative to the traditional structures of our university. The Biology Major needs a clear, transparent administrative structure. The home for the Biology Major, whether in IBE or a real or virtual Department of Biology in CALS and/or L&S, must have undergraduate biology education as one of its primary missions. Should the home of the major not be IBE, it will be vital to formalize an ongoing partnership between the Biology Major and IBE, say with a Memorandum of Understanding signed by appropriate Deans and the Provost. There are many advantages of such a partnership, particularly in terms of innovative courses and programming that complement formal instruction and build community for students, faculty and staff. It is also important that such a partnership be inclusive of other biology majors.

The major is now at a critical point, demanding immediate action for its health and for the needs of students. IBE was never given adequate resources for professional staff advisors, and the number of faculty advisors has not keep pace with the growth. Hence, the professional staff have become the advisors of record for EVERY student in the major, and they are swamped by the tremendous volume of students. Resources should be immediately provided to add one more FTE professional staff advisor; there should be a minimum of 1 FTE per 3-400 students in the major. Further, faculty need top down encouragement (from Deans and Department Chairs) to change the culture in favor of faculty involvement in the Biology Major, in areas of advising, oversight (BMEC), and community building. Incentives should be provided to departments with lower numbers of departmental majors to encourage such faculty involvement. The peer advising program should be re-instated provided that peers receive adequate training from the professional staff and faculty advisors. Better coordinated SOAR advising is needed to connect advisors

for undeclared majors to biology advisors. Ideally, create a biosciences advisors consortium, including staff and faculty, to facilitate this effort.

Resources are needed for advising (see above), laboratory courses (notably Neurobiology), post-degree assessment and continued support of Co-Chairs of the Biology Major. In addition, funding for programming support that complements all biology majors is extremely important for building community; we note in particular the Biology Community and Learning Center and BioHouse being developed through IBE.

Active steps should be taken to make connections with alumni. The largest major on campus should command Foundation attention. Further, establishing a relationship with alumni is important for the success of the major on several fronts, including the over-arching goal of preparing students for successful careers. We recommend establishment of a Board of Visitors with a deep interest in the university in general, and in biology specifically. Career Day events would attract biology students, providing them with examples that they may pursue. Career days also help foster a sense of community, which students in the major noted was lacking.

This large major has no single physical or intellectual home for the diverse group of students and the faculty who serve them. Creating a greater sense of community would make the Biology Major, and likely other the many other biology majors, more satisfying and intellectually rewarding for students and faculty. In addition, a greater sense of community is likely key to a successful relationship with alumni. We applaud IBE for partnering with Housing to launch a BioHouse Residential Learning Community in fall of 2013 to house approximately 130 students annually (2 floors). There is a sense of community within the Neurobiology Option. A second Option, Evolution, is too small to evaluate yet. However, these smaller communities within the large major allow greater interaction among students and faculty with similar professional interests. Increasing the number of Options, regardless of the "home" of the Biology Major, would substantially increase the sense of community. Re-establishing peer advising with strong faculty involvement will help build community and provide leadership opportunities for advanced students.

The Biology major presents a challenging and comprehensive set of courses designed to equip students well for either professional employment or more advanced training in the health professions or research. The major takes good advantage of the wide array of biology courses on the UW campus and provides considerable flexibility for students to select courses that match their interests. Nevertheless, the large size of the major has placed pressure on the introductory gateway courses and on certain intermediate and advanced courses of special relevance to the major, notably laboratory experience. We suggest modifications of the curriculum that might allow it to serve our students better while reducing administrative and advising overhead when possible.

In summary, the Review Committee finds the Biology Major to be a positive degree program at UW-Madison, but one in need of serious attention and reorganization. Given that many aspects of the major are currently in flux, with parallel assessments of Introductory Biology courses and the Institute for Biology Education (IBE) and interim heads of both CALS and IBE, the Review Committee offers to revisit the Biology Major with campus administration in 6-12 months to review progress.

Biology Major 10-Year Review Report
23 January 2012

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The Biology Major grew out of a campus-level faculty-initiated effort to provide an undergraduate face for biology at UW-Madison that recognizes the diversity and strengths we offer. This effort was planned in the 1990s but had its roots much earlier. The actual major was a formal modification in 1999 to the School of Education Biology Major, adding CALS and L&S with a detailed curriculum. The major has grown over ten years from small numbers to become the largest major on campus, with over 1200 undergraduates currently and no sign of a plateau.

The Biology Major has been a tremendous success for students. Moreover, the broad biology theme of the major resonates well with both students and faculty. However, certain aspects of the major have presented challenges for students, faculty, staff and administration. It was clear to the review committee that there is substantial frustration with aspects of the structure and governance of the Biology Major that need to be addressed as we move forward.

This 10-year review highlights concerns and offers recommendations about the administrative structure and home, advising, curriculum, resources, alumni relations, and community connections for the Biology Major. The Review Committee constructed this document in an unusually open manner, iterating drafts that were circulated to key parties for feedback. The Committee took this approach because of the unusually diverse and complex aspects of the Biology Major, but the Committee does not feel this approach unduly influenced the reports by any specific interest. While some of the recommendations in this report are specific, they are meant as guides for administrators, faculty and professional staff involved with the major.

The 10-year Biology Major Review Committee recognizes that many aspects of the major are currently in flux, including the continually rising number of undergraduates served by the major. Further, we are aware of parallel assessments of Introductory Biology courses, notably Biology/Botany/Zoology 151-152, and of the Institute for Biology Education (IBE). Additionally, both CALS and IBE have interim heads. In light of this unusual fluidity, the Review Committee would be happy to meet with the Biology Major and campus administration again at some future time, say 6-12 months hence, to review progress on the concerns and recommendations presented here.

We also explicitly acknowledge the several audiences that we are addressing, notably the Biology Major Executive Committee, the IBE and its Steering Committee, the Deans of CALS and L&S, and the Provost’s office, especially Aaron Brower, and the University Committee.

1. Administrative Structure and Home

Clear administrative structure is key to a successful Biology Major. There need to be over-arching priorities identified in its mission that translate directly into achievable goals. Further, the responsibilities of all parties needs to be unambiguous and transparent.

1.1 Vision and Mission of Biology Major

A vision is a long-term view of an organization, looking into the future of itself and its environs. A mission is a statement of purpose, succinctly identifying why it exists and what it does. The mission statement should guide the actions of the organization, spell out its overall goal, provide a path, and guide decision-making. It provides "the framework or context within which the company's strategies are formulated." (Wikipedia).

The Biology Major does not currently have a vision or mission statement. The Biology Major web home page describes for whom it is designed (students with broad interest in biology, or in specific sub-disciplines) and how it operates for their benefit (determine program with a biology advisor). Vision and mission statements of the Biology Major need to be created to move forward effectively. Most importantly, the mission will help identify funding targets to which the college Deans and the Provost can respond. Below are some suggestions**.** Please note that we encourage the Biology Major Executive Committee to reformulate these suggestions to meet their needs.

EXAMPLE VISION STATEMENT: The Biology Major aims to provide students with a well-rounded background in the biological sciences, including hands-on research or clinical experience. These students will disperse across academia, industry and government with a deep understanding of the meaning of life, and of the importance of an undergraduate education from UW-Madison. The major is designed to help students define their specific interests in biology in the first two years and prepare them to transfer to a more specific biological sciences major, should they choose to do so.

EXAMPLE MISSION STATEMENT: The goal of the Biology Major is to provide a high quality undergraduate education in the biological sciences, with possible specialization in an option. This is achieved by 1) maintaining a curriculum consisting of non-biology prerequisites, core biology courses, and a structure of biology electives that ensures broad training; 2) nurturing professional staff advisors who oversee the operations of the major for the students’ benefit; 3) building and training a community of faculty advisors that provides the formative connections to course content, research experiences and career trajectories; 4) establishing a welcoming environment that develops community among students through training and group-building activities, both in-house and on-line. Decision making for the major involves the Biology Major Executive Committee (BMEC) in conjunction with the home unit of the Biology Major. Specifically, the BMEC oversees curriculum and intellectual direction of the major, while the home unit oversees the governance and administrative aspects of the major, including budget for professional staff. Note that while content and selection of instructors for biology courses may lie elsewhere, the BMEC has the responsibility to represent the instructional interests and needs of the Biology Majors to the units that control those courses.

1.2 Parent home of Biology Major

Because the Biology Major was constructed to span Colleges and Departments, it has remained an orphan, or step-child, degree program relative to the traditional structures of our university. While this status has worked relatively well for the two other bio-science majors housed within the Institute for Biology Education (Molecular Biology and the Biological Aspects of Conservation), the Biology Major draws from even more departments and courses and has grown rapidly to become the biggest major on campus. This size and complexity has imposed several problems that we explore in this Report. Unfortunately, the solutions to these problems have also often foundered on the fact that the Biology Major is not the primary responsibility of any one department, institute or college. However, these problems should not obscure the fact that the cross-college, non-departmental structure of the Biology Major has also afforded it some special strengths, particularly by allowing it to draw freely from the remarkably broad and strong range of UW courses in biology and a talented and diverse pool of faculty, as well as faculty and staff advisors.

The CALS and L&S versions of the Biology Major were technically included as modifications to the existing School of Education Biology Major in 1999, and quickly grew from nothing to be the largest major on campus in just over a decade. IBE was formed in 2004 and took over administration of certain aspects of the Biology Major, particularly professional staff advising of students. This worked fairly well when the Director of IBE was also a Biology Major advisor, but a lasting, formal relationship was never established.

The infrastructure to support the Biology Major did not keep pace with the growth of the major itself during this period. In particular, advising of students is now at a critical point, demanding immediate action for the health of the major and the needs of students. To be clear, the Biology Major is currently understaffed with professional advisors because of a perfect storm: IBE was never given the resources to hire enough advisors, and the number of faculty advisors did not keep pace with the growth. As a consequence, the professional staff have become the advisors of record for EVERY student in the Major, and they are swamped by the tremendous volume of students.

1.2.1 Administrative Structure Choices with Advantages and Disadvantages

Here we lay out a set of possible future administrative structures for the Biology Major, but we have avoided making a recommendation of one over another as much as possible. Many issues raised later in this report remain regardless of the option. We comment where we think the choice of option may have a noticeable impact on specific issues. **All options will require adding resources** for professional advising staff and maintaining some form of buyout for the Chair, or Co-Chairs, of the Biology Major. The home for the Biology Major would need to have undergraduate biology education as one of its primary missions.

Given the cross-disciplinary nature of biology, any administrative structure is likely to be a compromise. We believe the three viable **administrative structures** for the Biology Major are:

1. Remain within IBE, with structural changes.
2. Move to a real or virtual department in one college (L&S or CALS).
3. Move to real or virtual departments in two colleges (L&S and CALS).

For the latter two choices, there is the choice of absorbing the Biology Major into an extant department, creating a new department, or creating a virtual department that

has faculty spanning multiple departments. Regardless of the choice of structure, the mission of undergraduate education must be central to the home. This home would be unique in the culture of this campus. Therefore, it cannot be considered lightly.

A choice that we do not consider viable is moving advising on its own to central campus under the new Director of Advising. There would be no clear mechanism to advocate for student interests or to build community. However, strong liaison with this director will be extremely important, especially with regard to SOAR and quality advising of undeclared students on majors in the biological sciences, including the Biology Major.

Regardless of the choice of home for the Biology Major, it will be very important moving forward to develop and nurture an ongoing partnership between the Biology Major and IBE. This needs to be clearly codified in a **Memorandum of Understanding (MOU)** signed by appropriate Deans and the Provost and addressing resource issues. There are many advantages of such a partnership, particularly in terms of innovative courses and programming that complements formal instruction and builds community for students, faculty and staff. It is also important that such a partnership be inclusive of other biology majors.

Further, there are clear **resource issues**, which are addressed in detail in sections 2 and 3 of this report. Funding for staff advising is critical, and continued buyout or release for faculty in leadership roles is vital. Further, the Biology Major and its home need space for staff, governance, and for programming related to the major.

1.2.2 Choice of leaving Biology Major within IBE.

The IBE has become in many ways the focal point for biology education at UW-Madison, creating cross-campus collaborations and relationships. This choice maximizes opportunities for synergy between the programming arm of the IBE (the old CBE) and the Major, specifically to connect Biology Major students beyond the classroom learning experiences through the new Biology Community and Learning Center, where these kinds of activities will be developed. It connects faculty and staff who are engaged in cross-campus and beyond campus IBE initiatives to incorporate Biology Major students in their initiatives.

However, the major is not currently the top priority of IBE, and changing that could require substantial shifts in the governance of IBE. Further, IBE has no faculty of its own, except possibly the Director. Introductory biology courses are staffed by faculty from many departments, with no necessary allegiance or ties to IBE. IBE has no leverage to recruit faculty as advisors for the Biology Major. IBE excels in many other creative programs, involving K-12, undergraduates beyond those at UW-Madison, post-docs and UW faculty; however, these draw IBE’s energies away from administering the Biology Major.

1.2.3 Choice of moving Biology Major to one department.

Moving to one existing department would have the advantage of utilizing existing governance structures. However, the huge size of the major could require substantial realignment of the mission of that department. Culturally, this choice would be counter to the strong sentiment expressed by faculty that “biology spans the campus”, as it might not adequately address issues arising from students and faculty in other colleges. This choice is not realistic in the Committee’s opinion.

A single cross-college virtual Department of Biology with the mission of undergraduate biology education could include faculty across colleges. However, its

unique structure could be challenging for college deans, particularly given the huge size of the major.

A viable alternative is to create a new (real or virtual) Department of Biology in one college (CALS or L&S) with the mission of undergraduate biology education. This would be administratively simple, creating clear lines of responsibility, and would enable established mechanisms for funding of pressing needs. It could connect most introductory biology courses to the major and lead to better control over curriculum changes. However, it has the risk of disenfranchising one college and students in that college, and it would not span the campus. It places one large department in a college, which could upset the balance of existing governance. It would also be unique and untested for this huge a major, hence challenging the established faculty governance models.

1.2.4 Choice of moving Biology Major to two (or more) departments.

The Biology Major could be embedded in two or more existing departments, with at least one department in L&S and one in CALS. The BMEC would be joint between these two departments, and interested faculty from other departments could have affiliate appointments. This model is employed in the new **Environmental Sciences Major**. There is a natural choice in L&S of Zoology and/or Botany, but the choice is less clear in CALS, where undergraduate biology is spread across most departments.

An alternative is to create two (real or virtual) Departments of Biology that meet as one, in a similar vein to the Laboratory of Genetics. This could involve, for example, putting administration of introductory courses in a L&S department and advising in a CALS department. One new advantage of this dual choice is that it honors the distinct cultures of CALS and L&S, reflected in their respective flavors of the major and their instructional missions.

1.2.5 Potential advantages of having the Biology Major in one (or two) department(s):

- The department faculty could control the budget and content of the introductory biology courses as they could be placed in this Biology Department.
- The timetable entries would be developed and maintained by the department. It would be important to have a clearly defined partnership for the Biology timetable (as part of the **MOU**) to enable IBE to continue developing courses through this mechanism.
- The other interdisciplinary biology majors could conceivably be housed in this department as well. This is not a foregone conclusion, of course.
- Department faculty outside of L&S or CALS could have joint appointments (0% affiliate, or positive % for teaching or advising), which would give legitimacy to those in VetMed, SMPH and other schools and colleges who want to formally belong.
- The Chair (or Co-Chairs) of a virtual department would have the same buyout and teaching release considerations as other Chairs.
- A department structure provides a faculty-centric, legitimized place to build community and a power base for influencing policy. It also helps focus relations and builds on a sense of community.
- The department could be a tenure home for some faculty with biology education as their primary sphere of excellence.

- The department(s) would have a natural partnership with IBE (see beginning of Section 1.2.1 on **MOU**) and be actively involved in new ways with IBE. These could include:
    - BMEC meetings could continue to be held in IBE space.
    - Continued involvement in the excellent faculty training done by CBE.
    - Developing fellowship through the new Biology Community and Learning Center.
    - Maintain some professional advising for the Biology Major in space proximate to IBE.
    - Cross-college advising for other biology and undeclared majors should develop a strong working relationship with the professional advising staff for the Biology Major.
- The professional advising staff for the Biology Major would have one boss, reporting directly to the Chair (or Co-Chairs) of the department(s).

1.2.6 Consequences and other issues for Biology Major in department(s):

1. What would be the home of the other interdisciplinary biology majors-- Biological Aspects of Conservation (BAC) and Molecular Biology? Would they also be appropriately placed in this department or departments?
2. How would the Executive Committee be formed, and what would be its scope? It would seem at first glance that the department could have many (>100) affiliate faculty, but a much smaller number of faculty with positive percent base appointment to cover instruction, advising and/or leadership. The subset of tenured faculty from this smaller set could presumably serve on the Executive Committee.
3. IBE has provided an important intellectual home for biology on campus. There is great potential for synergy among IBE's wide array of creative projects and the biology majors. It is clear that the excellent programs and strong focus on faculty and staff activities, coordinated through the former CBE portion of IBE, are quite valuable and build community among biologists that spills over into the undergraduate programs. Similarly, K-12 training has a complementary role in connecting pre-college biology to college biology education. In many senses, IBE is very much in the K- education business and has much to offer the biology majors. The key is developing a structure that will preserve the breadth and creativity of the work done by the "old CBE," so that it continues to exist for the students in the Biology Major (and other biology majors) to benefit from. For example, IBE needs to be able to continue to develop and maintain biology-based outreach programs in order to have these opportunities for our undergrad (and grad) students to participate in. Please note need for an **MOU** between IBE and the Biology Major discussed in subsection 1.2.1.

1.3 Administrative structure of Biology Major

A key question that came up repeatedly during the review is: "Who's in charge?" This is a major factor in the frustration level among all parties involved in the major. Who makes decisions about the core introductory biology courses? Who do professional staff report to? How is the curriculum modified? Who controls the funding? These questions do not have easy answers. While this review does not dictate a structure, it should provide some insights and ideas to help guide rethinking.

According to the 2011 Draft IBE Organizational Chart [see Appendix 1], there are two chains of command for the Biology Major. The IBE Director oversees the Associate Director, who then oversees the Undergraduate Student Programs & Services Team Leader, who then co-oversees the Student Services Coordinators with the Majors Oversight Committee (MOC). The IBE Director and the (co-)chairs of the Biology, BAC and Molecular Biology majors form the MOC, which also oversees the Student Services Coordinator / Majors Office Manager (one person). The Majors Office Manager oversees the Majors Office & Admin Support personnel (currently one person). The Co-Chairs of the Biology Major Executive Committee (BMEC) serve on the MOC. The IBE Steering Committee (SC) is a transitional body with an ad hoc charge to "advise the Interim Director on faculty governed academic areas of … the cross-college undergraduate majors". This structure has had the effect of submerging the Biology Major to the 3rd administrative tier, rather removed from the Director and leadership of the IBE.

To complicate matters further, funding for the biology majors comes from the Provost's office, while students in the Biology Major declare either CALS or L&S as their college, involving the deans of these colleges in questions of governance. IBE has been saddled with responsibilities for the Biology Major (and two others) without a suitably corresponding transfer of authority and funding to properly handle these functions.

This has led to an environment where the professional staff report to multiple units for possibly overlapping duties. Further, the BMEC feels particularly powerless, as they can modify the curriculum but have no direct control over courses, staff or funding that impacts the Biology Major. A less formal but equally confusing situation arises with recruitment of faculty advisors, which has fallen to the overworked professional staff advisors, whereas it should most likely be in faculty hands. [BMEC faculty have heavy Biology Major advising loads by default.]

An important additional concern is for biology courses crucial to the Biology Major. This includes the introductory biology courses as well as laboratory courses. While the Biology Major, and in particular the BMEC, have no direct control of course budgets, they should be involved in a substantial way in any fiscal decisions concerning these courses. Since the Biology Major is now the largest major on campus, its voice should be heard concerning the needs and priorities of instruction.

This administrative structure could be greatly simplified by adopting one of the Department of Biology choices presented in the previous subsection. Such a change would also empower the BMEC with control of introductory courses if those courses were placed in the Department(s) of Biology. Advising staff would report to one boss. Further, the Biology Major would have a governance structure familiar to faculty in the form of a department home.

1.4 Relation to other majors

UW-Madison offers 33 possible biology majors, not counting the soon-to-be-discontinued one in the School of Education or the Options to the Biology Major. Two of those majors, Molecular Biology and Biological Aspects of Conservation (BAC), are jointly administered through IBE and L&S, while the others are spread across multiple colleges and schools, but primarily CALS and L&S. The original intent of the Biology Major in 1999 was to serve as a conduit to these other majors. In fact, some of these majors have shrunk while the Biology Major has experienced meteoric growth. There could be reasons for this shift, but the fact is that students are electing to stay in the

Biology Major. In fact, students the review committee met, confirmed by surveys, like the broad nature of the Biology Major.

One question the review committee grappled with is whether UW-Madison should adopt the Cornell model, in which nearly all biology majors are "concentrations" within one over-arching biology major. Such a change would likely involve years of preparation, but there is already movement in that direction, for instance in the streamlining of CALS undergraduate majors. Note that Cornell's system allows for concentrations within the biology major as well as stand-alone majors that may be markedly similar (notably entomology and microbiology). An important contrast between Madison and Cornell, however, is that for a number of departments at Cornell, the over-arching biology major is the sole major.

Students clearly stated after our luncheon with them that they would like to see more formal Options. Part of this was likely driven by a desire for community, a way to foster shared scholarship. However, no specific Options were suggested during our meeting, although some are listed in exit surveys by former majors.

The review committee would recommend that the top echelons of UW-Madison--the Provost and the Deans of CALS and L&S--initiate a discussion of future options for biology majors, within the Biology Major or beyond, that allows considerable latitude. This would readily fit within the guidelines of the Education Innovation initiative, as it promises cost savings in terms of administration as well as new, creative learning opportunities for undergraduates. We remark in this context that Associate Provost Aaron Brower has noticed a shift in culture nationally away from the importance of a particular major toward the importance of a collection of skills that an undergraduate amasses through their educational experience.

2. Advising

A critical concern regarding the Biology Major is student advising. The number of students in the major is over 1200, the largest major on campus. The original intent was for every undergraduate in the Biology Major to have a faculty advisor, but faculty involvement has not kept pace with the growth of the major. Recently, the professional staff were authorized to be advisors of record, and undergraduates have largely turned to these staff for most course advising needs. This combination of circumstances has led to intense pressure on the professional staff.

2.1 Professional Staff Advisers

There are insufficient academic staff advisors to meet the needs of the current and growing number of Biology majors. This has placed significant strain on the advising system. The student body is not being well-served and the advisors are over-stressed. Morale of the current support staff is low. At present 1.4 FTE staff advisors provide support for the Biology, Molecular Biology, and BAC majors. This level of advising support is woefully inadequate when one considers that 1.4-1.8 FTE staff advisors, plus Pat Hendrickson as general biology advisor, were available when the Biology Major had about 700 students. An apparently successful peer advising program was suspended because of inadequate support staff.

An additional full-time staff advisor position was just filled using MIU funding; this new advisor will focus on serving underrepresented and at risk student populations as well as general advising of the three majors. This will alleviate some of the overload being carried by the current advisors; however, given the large number and continued projected growth of the Biology major, additional staff support is needed.

The currently low morale of the support staff must be addressed immediately. The imbalance between career aspirations (approximately 75-80% health science emphasis) versus health science faculty advisors (approximate 23% SMPH) also makes it difficult for the majority of students to get the type of career advising they need. The biology advisors at IBE and the Center for Pre-Health Advising have established a strong working relationship, which helps in this regard.

It is important to note that many of the larger majors on campus--including political science, chemistry, biochemistry, bacteriology, zoology and computer science--rely heavily or entirely on professional staff to advise undergraduates in their major. It seems timely for the Biology Major to consider such a move, and dramatically redefine the role of faculty in the major.

2.2 Faculty Advising and Involvement with Students in the Biology Major

The Biology Major Executive Committee has recently been redefining the roles of faculty advising and professional advising. We view this as very positive, and would encourage even more dramatic shifts.

Since the biology major does not have a true departmental home, faculty advisors are recruited from L&S, CALS, and SMPH plus a few additional individuals from the School of Veterinary Medicine. Faculty advisors currently number between 70 and 80, but the load per advisor varies considerably with some faculty advising as many as 35-45 students. Recruitment of new faculty advisors has not kept pace with the expansion of student numbers in the major, and recent recruiting has fallen to the support staff. Because of this severe lack in faculty advisors, many students in the Biology Major do not receive an assignment until they reach junior status. Faculty advisor numbers are too small to adequately advise Biology Major students. This needs to change, towards involvement of hundreds of faculty in the Biology Major, for the sake of the students.

Faculty have important roles in the Biology Major that could be enhanced by focusing the limited available advising time on professional and career advising. At the same time, more faculty are needed for the following: 1) oversight of the major and professional staff advising through BMEC, 2) supervising more capstone/laboratory experiences, 3) getting involved in biology community building activities, particularly those coordinated by IBE, and 4) mentoring peer groups or clubs focused on biology related subjects.

2.3 Peer Advising

The Biology Major developed a peer advising system modeled on the very successful program at the Cornell University Biology Program. However, it was discontinued when staff was cut. The Review Committee encourages rebuilding peer advising to enhance community and provide leadership opportunities for advanced students. This peer advising system for the Biology Major should coordinate with peer advising for other biology majors across campus.

Peer advising has to be implemented carefully. Peers must be affiliated with professional staff, having access to work space for meetings and offices, and must have a faculty mentor. This will encourage a community of biology advising, with initial professional training, early mentoring by faculty, and staff supervision of ongoing peer advising. We anticipate a need for 20-30 peer advisors, each handling 10-12 student. Thus, 10-15 faculty will need to be actively involved (2 peers per faculty). Ideally, members of BMEC would be peer mentors, recruiting additional

mentors as needed. In addition, it will be useful to have a peer advisor ex officio on BMEC to provide feedback.

IBE staff had developed a two-day training program and designed a focused weekly meeting program that included sessions with policy deans, McBirney Center staff on accessibility, as well as time for feedback, assessment and acting out realistic scenarios. While professional advisors will largely conduct training, faculty need to be involved at key junctures, such as providing feedback on initial peer advisor meetings with younger biology students. Faculty will model good advising, and will offer professional and career advice to peer advisors and, indirectly, to their advisees. Faculty are the point of reference to match up advanced students, and must be involved for special situations, such as probation, capstone course equivalencies, exception forms and policy. Professional staff should continue to refer to faculty as needed for student issues involving both peer advising and other forms of advising.

Peer advising should include both one-on-one relationships with a modest number of students and open office hours (say 10-12 daily on a rotation) for drop-in sessions with a much larger pool of students. Peer advising would be open to all biology undergraduates, including those undeclared. Peer advisors can help with L&S Prospective Student Days, and will have advice on how to join student organizations, learn about study abroad, find a research lab, etc. Peer advising largely follows the academic calendar largely. Welcome Week will be important for building community. Training occurs in the Fall. New peer advisors are largely recruited in the late Spring.

Advanced undergraduates want to do be peer advisors, to give back what they learned to the next class. When it was active, there were three times as many applicants for peer advisors as there was room. Thus, it seems unnecessary to provide monetary incentives to peers, although programmatic support, including food events, will enhance the experience and community sense.

The peer advising program should be re-instated provided that peers receive adequate training from the professional staff advisors and have initial and continued oversight from faculty. Faculty must be explicitly involved in peer advising for it to be successful. Peer advising could complement expansion of peer groups that build community.

2.4 Recommendations

- Resources should be **immediately** provided to add one more FTE professional advising staff. Ideally, professional advising staff should focus on advising and program support for the biology majors. There should be a minimum of 1 FTE per 3-400 students in the major to meet time demands for advising and related program development.
- Professional staff advisors for the Biology Major should report to one unit. At the same time, strong relationships are needed between these advisors and other cross-college biology advisors, and with programmatic developments through IBE, in particular BioHouse and the Biology Community and Learning Center.
- More faculty need to be involved in the Biology Major, ideally several hundred. Faculty need top down encouragement (from Deans and Department Chairs) to change the culture in favor of such involvement. Incentives may be needed for departments with lower numbers of departmental majors to encourage such faculty involvement. Students are choosing this major for its broad scope. This creates faculty opportunities to build community, and to redirect some students to more focused majors, or to Options within the Biology Major.

- Repurpose faculty involvement in the Biology Major. Faculty advising should focus on professional and career issues after staff advisors have addressed curriculum, transfer credits, graduation requirements, DARS etc. In addition, more faculty should be encouraged to be involved in oversight (BMEC), capstone supervision, and community building activities, particularly those developed by IBE.
- Student advising needs to become an expected part of a faculty member's duties. Consider a flexible system of points for instruction and advising. For instance, L&S has an 80% instruction rule for 1 FTE. If advising is considered to be 5% additional work load, then faculty have 85 percentage "points" to negotiate. That is, a department could internally reallocate these points based on faculty preferences so that *on average* each FTE covers 85 points of combined teaching and advising. [This recommendation goes beyond the Biology Major, of course.]
- A training program for faculty advisors should be developed. Staff in the "old CBE" of IBE are very interested in being involved in this training, but they need a formal invitation to develop such a program.
- A clear delineation of separate responsibilities of faculty versus staff with regard to the Biology Major should be developed, building on progress already made by BMEC. Thus, advising questions on course substitutions, scheduling, drops, and DARS could be primarily handled by staff advisors while career questions would be handled by faculty. Both faculty and staff should be involved in building community. This division of labor may help in the recruitment of new faculty to the Biology Major.
- The peer advising program should be re-instated with a well-designed training from the professional staff advisors and continued oversight from faculty. Faculty must be explicitly involved in peer advising for it to be successful. Peer advising could complement expansion of peer groups that build community. Professional staff overseeing peer advising will need release time for professional development.
- Better coordinate SOAR advising to connect CCAS and advisors for undeclared majors to biology advisors. Ideally, create a biosciences advisors consortium, including staff and faculty, to facilitate this effort.

3. Resources

Lack of sufficient resources is a major challenge for the Biology Major. The explosive growth in the number of students enrolled by the major has not been matched by corresponding increases in funding to support it. This has hampered efforts in student advising and laboratory course development. In addition, resources are needed for post-degree assessment and tracking, Co-Chair funding, and programming support. The following list of resources need to be adequately addressed through the administrative home of the Biology Major:

1. Staffing for advising, administration of Options, assessment
2. Co-chairs' salaries (currently 2 weeks summer salary for each)
3. Office budget (computers & software, phones, supplies, printing, reception, student hourly)
4. Meeting and office space
5. Faculty involved in the Biology Major (advising, oversight, capstone, community)

6. Funding for supplemental activities (student clubs, peer learning, program planning needs)
7. Funding and release time for professional development of staff
8. Funding for course development, improvements, including labs
9. Access to alumni donations and the proposed BOV
10. Influence and visibility

Currently, the Biology Major has access to funding for only the first four of these, with office budget informally granted by IBE without a separate budget line. Faculty involvement is voluntary, and there are no funds for supplemental activities or course development, and no access to alumni donations.

Funding for the Biology Major comes from the Provost's office through IBE. However, many issues about the Biology Major involve the Deans of CALS and L&S, who have no direct involvement at this time in the budget. **Future success of the Biology Major**, particularly if it moves from IBE to one or more departments in L&S and/or CALS, requires explicit **commitment of new funds** from the dean(s) to address these resource needs.

3.1 Advising

<see section 2 above>

3.2 Laboratory course development and equipment

One of the strengths of the Biology Major curriculum is the requirement for intermediate/advanced coursework with laboratory experience. A challenge is lack of sufficient lab courses in some areas. For example, the Neurobiology Option has about 160 seniors and juniors. Currently there are two Neurobiology Laboratory courses. Neurobiology faculty would like to set up another lab course that can take about 24 additional students, but are unable to do so because of lack of funds to acquire the necessary equipment and to staff the lab. Potential curriculum revisions in some Introductory Biology courses, e.g., Biology 151/152, may also require resources for development of lab sections for experimental learning.

3.3 Post-degree assessment and tracking

The Biology Major has employed a survey of 500 alumni in 2006-07 and exit interviews every semester of graduating seniors to assess the students' satisfaction with the Major's curriculum and advising. A new survey tool has been developed that will provide more quantifiable assessment of the effectiveness of the Major and the students' readiness for a professional life. Continued use and development of these assessment tools is essential. In addition, it is important to develop assessment tools that do not rely on student self-reported data. For example, surveys of faculty instructors and advisors about the impact and effectiveness of the major could be developed. It is also important to be able to reach the enormous number of Biology Major alumni, not only for survey and assessment purposes but to help build the biology community, provide career guidance for current Biology Majors, and potentially assist in fund-raising for the Major (see next two sections). However, there is no formal mechanism to track these alumni, so we run the risk of losing an invaluable resource and missed opportunities.

3.4 Support for Co-Chairs

Historically each of the CALS and L&S Co-Chairs of the Biology Major has been compensated by IBE with 0.5 month summer salary or its equivalent in research funds. Limited funding has put this support at risk. Loss of funding for the Co-Chair positions would significantly reduce the incentive to serve, and ultimately this will hurt the Biology Major. It is imperative that the Co-Chairs continue to be compensated, especially with the recent expansion of the Co-Chair roles in the IBE Majors Oversight Committee. An additional compensation scheme involving release of teaching obligations would make this more similar to Chair and Associate Chair buyouts in most departments.

3.5 Programming support

Resources are needed to support basic services and programs that enrich the experiences of Biology Majors. Some of this programming support would actually be outside the Biology Major, and serve the broader community of biology undergraduates as well. For example, a Director for the new Biology Community and Learning Center could develop programs that are attractive to students interested in biology, provide a nurturing and vibrant place for networking and exchange of information and resources and a "home" for Biology Majors. This center could serve as a hub where significant synergy can be developed between the undergraduate, faculty, and outreach programs overseen by IBE. This Biology Community and Learning Center would be ideal for nurturing an ongoing partnership between the Biology Major and IBE, regardless of the eventual home of the major.

Support for Internet resources would greatly enhance community aspects for students and faculty, both in terms of web content for the Biology Major, social media such as FaceBook and Twitter, and smart media or emerging learning genres such as podcasts, TED talks, etc. There is great potential in partnering, for instance, with the Digital Humanities Initiative and its Wisconsin Studio System. However, engaging students in these ventures and building resources takes staff time.

Staff for the Biology Major also need release time and travel support for professional development. It is important to support the continued enrichment of the professional staff who actually create much of the programming environment for biology undergraduates.

3.6 Recommendations

We recognize that these are exceptionally tight fiscal times. The explosive growth in the major, however, and its shear size, demand investment of resources.

- Provide funds to hire one more full-time staff advisor, as noted earlier in this report.
- Provide funds to develop more lab courses for the Neurobiology Option; some funding for equipment purchase may be available from federal sources, e.g., NSF's TUES program.
- Ongoing revision of the curriculum may lead to expansion of lab experiences for some of the Introductory Biology courses, in which cases resources should be provided for development of such lab sections.
- Maintain 0.5 month salary support for each Co-Chair of the major. An important additional compensation scheme is release of teaching obligations, or a combination of salary and teaching release, as discussed earlier in this report.
- Provide resources to support the growing assessment needs of the Major and to develop mechanisms for tracking graduates. Enhance technical support for

tracking of current students and faculty advisors with tools that integrate DARS and ISIS more easily.
- Provide funding to develop the Biology Community and Learning Center as a resource for all undergraduate biology majors.
- Provide funding for professional staff development.

4. Alumni Relations

Once the administrative structure and home for the Biology Major is established, active steps should be taken to make connections with alumni. As the largest major now on campus, establishing a relationship with alumni is important for the success of the major on several fronts, including the over-arching goal of preparing students for successful careers. It is recognized that it is a challenge to connect to alumni in a major that has no department, and this underscores the need for a clear, and straightforward, administrative structure. Currently there is no mechanism for connecting with alumni, but if this is left unchanged, this will be a major missed opportunity.

4.1 Establishment of a Board of Visitors

Alumni relations are probably best consolidated through establishment of a Board of Visitors. Models may be drawn from the wide variety of BOV's on campus, which range from department to college or institute level. In general, BOV's on campus have a range of members from the private and public sectors, reflecting the range of careers students may take in particular programs. BOV's are commonly dominated by alumni of the university, but many have members who are deemed important but who are not alumni. In addition, many BOV's attempt to recruit members who represent a range of career stages. The most important component for a successful Biology Major BOV is recruiting individuals who have a deep interest in the university in general, and in biology specifically, including the Biology Major. Nominations should be sought from the major participating departments, colleges, and programs, evaluated by whatever entity is responsible for oversight of the Biology Major.

Based on the experience of other campus BOV's, a target membership of perhaps a dozen people is workable, with staggered initial appointment of 1-3 years, such that a steady-state condition will be produced where one-third of the membership is replaced annually. It may be attractive to allow members to serve two consecutive terms. It may also be desirable to encourage some or all members who rotate off to retain an advisory or alumni status, particularly for individuals interested in long-term relationships with the program.

A clear charge is critical for a successful BOV, and possible activities follow below.

4.2 Connecting alumni and current students

An active BOV can contribute to many of the issues raised elsewhere in this report with regard to career paths and community for students in the Biology Major. Alumni are often quite happy to share their career experiences with students, if asked. BOV-sponsored annual or bi-annual career days are often very successful. Commonly, the program and logistics of these events are jointly arranged between a campus group and BOV members. Career day events will be attractive to the student who prefers to stay general in the major, providing them with examples that they may pursue, as well as the student who has decided on a subject concentration. Career days also help foster a sense of community, which students in the major noted was lacking.

These events commonly include presentations and Q&A sessions by BOV members, other alumni, or recruiters. In addition, BOV members, or their institutions, are often willing to sponsor evening social and food activities associated with career days.

Additional alumni programs that have been successful on campus include mentoring programs and reunions. Such events are usually associated with programs that have long-standing relationships with alumni, but the exceptionally rapid growth and size of the Biology Major probably warrants a view looking forward. Alumni mentoring programs offer an opportunity for connecting motivated students with alumni who are interested in providing “real world” career advice. Successful alumni mentoring programs on campus have involved a BOV in recruiting alumni mentors, coupled with campus help in providing a web-based interface for connecting students with alumni based on interest. Given the large number of majors, some restriction of student participation is likely needed, perhaps based on recommendation of an advisor or faculty member. Organization of an alumni day is another charge that is sometimes given to a BOV, often in coordination with the Wisconsin Alumni Association. Themes for such events sometimes focus on a seminar series, and include student participation. Such events can bring students and alumni directly together.

4.3 Fundraising

An active BOV and series of alumni-sponsored activities provides the launching point for successful fundraising and development. Although establishing an active fundraising program will clearly require a significant up-front effort, it will be essential for the long-term health of the major. That many students in the major go on to careers in the health professions suggests that alumni fundraising could be quite successful.

Support for students often resonates most with alumni, and this can take the form of funding for scholarships and research experiences. These programs can start small, targeting non-endowed annual awards, and later build to establishing endowments to provide permanent funds. In addition to providing financial aid for students, a strong scholarship program helps address community issues raised elsewhere in this report. In addition, if widely advertised, a scholarship program can help address the issue that students declare the major at different times depending upon their college (an advising issue) - “early” declaration would allow students to qualify for scholarships.

Establishing a research experience fund will help address issues raised by students that it can be difficult to find research opportunities. Applications might include a list of labs that have openings, regularly solicited from faculty participating in the program. This in turn may help address the important issue of faculty buy-in, including participation as a faculty advisor. By highlighting the availability of a talented pool of students who have been screened (via the research fund application), as well as providing student stipends, faculty buy-in to the major is likely to increase. This in turn flows into many of the issues raised elsewhere in this report, including faculty advising.

Additional fundraising targets could include sponsorship of student clubs. Several are active in the Biology Major. Presentations by these clubs at BOV meetings would be a place to start to see if club sponsorship resonates with alumni.

One issue that needs to be addressed is the flow of funds from alumni fundraising efforts. To the degree that university funding for the major is consolidated

in a new administrative structure, it seems logical that fundraising should follow the same structure.

It is also recognized that coordination of fundraising through the UW Foundation is common practice on campus. Currently, the Biology Major does not have a connection to the Foundation, and competition for the Foundation's attention can be high. An active and visible BOV, however, would undoubtedly attract the attention of the UW Foundation that is required for successful fundraising for the largest major on campus.

4.4 Recommendations

- Establish a Board of Visitors once the administrative structure for the Biology Major is established. There are many BOV's on campus that can provide advice on setting this up.
- Establish alumni and student events in collaboration with the new BOV.
- Work toward establishing several levels of fund-raising activities, in close consultation with the BOV. Experience elsewhere on campus suggests student support often ranks highly among alumni interest.

5. Community

There is no single physical or intellectual home for this diverse group of students or for the faculty who serve them. Creating a greater sense of community would make the Biology Major more satisfying and intellectually rewarding for its 1200 students in CALS and L&S and involved faculty. In addition, a greater sense of community is likely key to a successful relationship with alumni.

5.1 Encourage faculty participation in Introductory Biology courses

The committee sensed a lack of commitment from faculty to participate in teaching, advising and enhancing Introductory Biology courses. It was perceived that faculty were concerned that participating in this dual-college, non-departmental activity was not valued by deans, department chairs, and faculty peers to the same level as departmental teaching within their college. Encouragement by deans and chairs for faculty to participate in enhancing and teaching Introductory courses and engaging students in activities that promote academic interaction early in their careers as biologists would be a positive step. If not already the policy, this would require college and departmental recognition of involvement with biology courses and biology students identical to recognition received for involvement with departmental courses and students. This would be a first step in building a "community" among biology instructors that would make the Introductory Biology courses a more valuable experience for beginning students. Building a commitment to teach in a particular introductory biology course into the job description of new faculty hires might be considered. Although departments would prefer to have 100% of the faculty member's time, they will take a 80% appointmen with 20% for biology rather than no position at all. This mechanism would enable deans to redirect support for the major, creating long term stability in meeting the introductory biology teaching needs.

5.2 Establish "Biology Learning Communities"

High school students who develop interest in biology and who are eager to explore these interests at the University may flounder with no identifiable physical home

(Department) as freshmen and sophomores. There are several examples of successful "residential learning communities" at UW-Madison. Development of a "biology residential learning community" in one of the dormitories would be an excellent way to connect with freshmen biology students beginning their first day on campus. This early connection would ideally provide a view of the vast opportunities (from Agronomy to Zoology) offered in the field of biology at UW-Madison.

The IBE is partnering with Housing to launch a BioHouse Residential Learning Community in fall of 2013. It will be funded by an MIU that was awarded to Housing. IBE is recruiting the first faculty director now, who will develop the programming. This community will house approximately 130 students annually (2 floors). Primarily first year students, but likely a few second year and transfer students will have spots.

5.3 Encourage smaller "communities" within the Biology Major

After hearing from faculty and students involved in the Neurobiology Option (approximately 200 students) within the Biology Major it was obvious that there is a sense of community within this sub-discipline. A second Option, the Evolution Option is much smaller (approximately 20). These smaller communities within the large major allow greater interaction among students and faculty with similar professional interests. It seemed clear to the Review Committee that increasing the number of Options, regardless of the "home" of the Biology Major, would substantially increase the sense of community. The Committee also realizes that even students who have a clear idea of where they are headed may wish to join to enhance their connections to a broader biology community.

5.4 Peer Advising

The Review Committee discussed the very successful peer advising system employed by the Cornell University Biology Program. The UW-Madison peer advising system, originally modeled after the Cornell system, has been mothballed (**see 2. Advising**). The Cornell model involves faculty members training of junior and senior students (a community building activity in itself), who then work one-on-one or in small groups with freshmen and sophomores. The peer advisors play a role in handling questions related to courses that they have had experience with, as well as serving as an accessible resource for finding answers to other academic issues. The Committee sees the discontinuation of the peer-advising system at Madison as a loss. In addition to providing important help in advising, a peer-advising system provides leadership opportunities for students.

5.5 Recommendations

- Deans and Departments encourage faculty involvement in Introductory Biology courses.
- Support development of a Biology Residential Learning Community and the emerging Biology Community Learning Center.
- Build additional Options and other mechanisms (bio groups, social media resources) to encourage smaller communities within the Biology Major and possibly identify a suitable, traditional departmental major.
- Re-establish peer advising by juniors/seniors to build student community.

6. Curriculum

The Biology Major presents a challenging and comprehensive set of courses designed to equip students well for either professional employment or more advanced training in the health professions or research. The major takes good advantage of the wide array of biology courses on the UW campus and provides considerable flexibility by allowing students with different interests to take intermediate and advanced courses to match their interests. The remarkable growth and current popularity of the major demonstrates the need that existed for a straightforward entry to the biological sciences and the success that the major has enjoyed under its current structure. Nevertheless, there have been some growing pains and the current large size of the major has placed pressure not only on the introductory gateway courses but also on certain intermediate and advanced courses of special relevance to the major, particularly those that provide the laboratory or field experience required in the major. Our goal here, then, is to build on the success of the Biology Major by suggesting further tweaks to its structure and requirements that might allow it to serve our students better. We were also sensitive to the value of reducing administrative and advising overhead when possible.

The **students** we interviewed had a variety of concerns with the Biology curriculum that echo and reinforce some of the points made above in Section 2. Students generally supported the overall nature, aims, and curricular content of the major but noted several issues related to satisfying requirements, finding suitable open courses, and their search for community and specialization within the major. Several students described their quest to find suitable courses to take, noting the inconsistent and often inadequate on-line information available for many biology courses. There is a useful Biological Sciences Course Guide that could become even more useful if it were to include an asterisk or other marker for those courses that count toward the Biology major.

While full syllabi and detailed descriptions are available for some courses, others are described with a single sentence, or descriptions may apply to a previous version of the course that has shifted direction. Unfortunately, there does not appear to be any way to force instructors to update their course descriptions each year nor are there more staff resources available to provide these. Many students also noted their frustration at being able to identify and take suitable intermediate to advanced level courses in their particular areas of interest given the scarcity of appropriate lab and field courses that satisfy the requirement.

We also asked about the success of current Option**s** within the Biology Major. Those in the Neurobiology Option gave it high marks for allowing them to specialize and for providing a sense of community. We sensed similar appreciation for the Evolution Option (but did not interview any students in it). Several other students said they appreciated the flexibility and many choices within the major and the opportunity not to specialize at a time when they were reluctant to.

We also interviewed the **professional advising staff** and L&S and CALS **Associate Deans** about the major. While acknowledging its success, the staff and deans also expressed frustrations regarding certain aspects of the Biology program and curriculum. Dean Essenmacher (L&S) compiled a list of 13 particular concerns expressed by advisors (**Appendix 2**). These included administrative issues like the duplication of effort and uncertain chains of command already reviewed in Section 1 that diffuse responsibility for the Major.

Splitting the major between two colleges with different sets of requirements has led to some duplications of effort and complicated the advising process. Some yearned to create a system wherein student experiences could be the same

regardless of which College students were in. They noted the duplications of effort and accounting required under the current structure and the wide disparity in other College requirements between CALS (12 credits) and L&S (27 credits) highlighted on the blue Biology Major information sheet. This disparity (and perhaps other factors) has led to a shift from the initial 2/3 to 1/3 L&S vs. CALS split of students in the early years to half or more of the current crop of Biology students choosing to complete their degrees in CALS (with uncertainty reflecting the fact that CALS students must declare majors early whereas L&S students are often discouraged from doing this). This CALS fraction appears to be increasing. They also noted the difficulty of coding the complex structure of the Biology Major into the DARS system in light of these disparate College requirements and the particular biology requirement for intermediate / advanced lab or field courses that include at least 3 hours per week of such work. Such lab courses are scarce and sometimes difficult to identify.

These interviews led us to compile a list of concerns (6.2) that we develop in more detail in the issues section below (6.3) before presenting our specific recommendations (6.4).

6.1 Concerns

- The large number of credit hours required in prerequisite and introductory courses
- The delay in starting introductory courses in their major
- Consequent challenges in providing timely and useful advice to Biology majors
- Coordination between Biology faculty advisors and professional staff in the Majors office and elsewhere on campus on how best to provide expert and timely advising for Biology students
- The complexity of requirements in intermediate-advanced courses
- The scarcity of intermediate-advanced courses in particular fields that provide the required 3+ hours per week of lab or field experience
- The large size and diffuse nature of the major and the obstacles these provide to fostering more of a sense of community among biology students and faculty
- The restricted number of alternative Options within the Major
- How expanding the number of Options might be viewed by departments with their own, potentially competing, majors
- How often Biology degree and course requirements were being reviewed and re-evaluated

6.2 Issues

6.2.1 Introductory biology requirement

Biology students now choose among **three different choices** to complete their required sequence of courses in introductory biology: Biology 151-152, Botany 130 + Zoology 101/102, or the 3-4 semester Biocore sequence (restricted to Honors students). Students usually start these sequences in their sophomore year after completing initial course work in math and chemistry but sometimes before they receive informed advising on the relative merits of each. In recent years, some freshmen have begun to take a Freshman Interest Group (FIG) seminar related to their interest in biology and often linked directly to another course they are taking. We consider these small enrollment courses ideal for stimulating interest in biology

and exposing freshmen to modern ideas and approaches. We also applaud IBE's new "Exploring Biology" course for first year and transfer students and efforts to further expand FIG offerings. Nevertheless, most students in Biology and related majors still defer taking biology until their 2nd, or rare cases 3rd year, delaying their entry to upper level courses.

In the past, the limited number of positions within our introductory courses sometimes restricted freshman, or even sophomore, access. We were thus pleased to hear that freshman have begun to find places in the course. We also heard of efforts to align 151 and the 1st semester Biocore course in a way that would allow transfers into Biocore after the 1st semester. This could benefit students in both sequences. Some also expressed concerns about the overlap in some topics (e.g., basic cell biology and Mendelian genetics) between Botany 130 and Zoology 101/102. Because each of these courses serves other constituencies on campus, however, it would be difficult to adjust their content.

There has also been uncertainty about the role of **Advanced Placement** (AP) credit for students majoring in the biological sciences, with only about half (or fewer?) of the eligible students taking advantage of their ability to place out of Biology 151 with a score of 4 or 5 on this exam. Some faculty also expressed concerns regarding the mismatch between what is covered in the AP exam and what topics are covered in each semester of 151-152 (e.g., topics in evolution and diversity that represent 1/3 of 151 are a relatively small component of the AP exam). To save student time and reduce the bottleneck and delay for students seeking entry to the Intro Biology courses, it would make sense to expand the use of AP credits to position students directly into 152. As this becomes more common, it would also make sense to redesign the **timing of** when **content** is presented within the 151-152 sequence to match 151 to the AP exam more and to defer topics that are covered less in the AP exam to Biology 152.

6.2.2 Credit load and distribution of prerequisite courses

As noted in the 2010-2011 Self Study, the Biology major requires a challenging and substantial number of courses in math (10-13 cr, often including 3 cr of statistics), chemistry (5-9 cr analytical + 8 cr organic), and physics (8-10 cr) in order to provide "rigorous training in sciences relevant to biology" (p. 13). These requirements total 31-40 credits, somewhat more than the 31+ credits required within Biology itself. Thus, actual required science credits for the Biology major total at least 62. Some we talked to questioned whether this might violate the L&S standard that a major require no more than 40 credits (though some other majors require similarly large sets of prerequisite courses). Some advisors felt that many freshmen were unaware of just how challenging the Biology Major was. However, the students we spoke with commented on this load but generally did not question it or complain about it, noting often that any pre-health student would take all these courses anyway. While moving toward direct entry into 152 via the use of AP credits would serve to reduce some of this credit burden, additional steps may be possible.

The Review Committee supports the need for a solid foundation in math and the physical sciences for students pursuing the Biology Major. We feel the number and level of these courses is appropriate for the majority of biology students. However, we also feel the Biology Major should be alert to opportunities that may arise to streamline these requirements where possible. We heard, in particular, of initiatives within the math and physics department wherein they are exploring ways to focus their introductory courses on topics most relevant to biology majors (a large

fraction of their students). We applaud these initiatives to improve the suitability of these courses for Biology majors. Given the status as the largest major on campus, it is appropriate to tailor more of the prerequisite courses to suit this group. We therefore encourage the BMEC to actively support and promote these efforts. This might be done by designating formal or informal liaisons to those departments who could participate actively in these re-designs and report back to the BMEC with details on their content.

Such curricular changes might also afford an opportunity to streamline the Biology prerequisites if they begin to offer new courses that use one semester to cover topics that formerly were covered in two. In particular, if a new bio-focused physics course emerges, majors might be given the option of taking only one semester of physics. Alternatively, Biology Majors not seeking later advanced degrees might be allowed to choose among 2nd semester calculus, 2nd semester physics, or the organic chemistry laboratory course. Either of these developments would trim the number of prerequisite courses by one (3-4 credits).

6.2.3 Intermediate and advanced courses

Biology Majors are currently required to complete one "Foundational" course as well as 3+ intermediate / advanced (I/A) courses worth 13+ credits. The **Foundational course** must be in either genetics (Genetics 466, Microbial Genetics 470, or Plant Breeding and Biotechnology) or biochemistry (Biochem 501 or 503 – Human Biochemistry). Students are advised to take one in each category and indeed these courses are the most popular I/A courses in the major (General Genetics - 1621), Intro to Biochemistry – 1493 – student enrollment numbers from Appendix 9 of the Self-Study). Students then proceed to satisfy the "**Biology Breadth Requirement**" by taking courses in 3 of 5 areas (A.-E.) with at least one of these courses providing a lab or field component of at least 3 hours per week. This requirement further stipulates that Biology majors must take one course from A or B, one from C or D, and the third from an unused area (A.-E.). In addition, a student taking a 2nd course in the Foundational set receives credit for that course here within the Breadth Requirement. These five categories offer a great number of courses (192). This wide choice plus the specific "either-or" requirements complicate advising and DARS programming. They can also sometimes act to restrict access to particular courses or options within the major. Let us consider these in detail.

The **Foundational course** requirement implicitly considers genetics and biochemistry to be equally suitable alternatives for training biology students. Both are indeed fundamental to biology but do they really substitute for each other? To allow a second of these courses to count for the majority of Biology students who take courses in both areas, both these courses also exist within Category (A) under the Breadth requirement.

The **Biology Breadth Requirement** requires one course in either (A) cellular / subcellular biology (59 courses) or (B) organismal biology (65 courses). Biology students must also take at least one course from either (C) ecology or (D) evolution or systematics (22 courses in all). The 3rd course can be in an unused area (including the 46 courses in E. Applied biology or the Foundational courses mentioned above). Currently, the most popular I/A courses for Biology students and the number of Biology students who have taken these courses (from Appendix 9 of the Self-Study) are:

- Category (A): General Genetics (1621), Intro to Biochemistry (1493), and Immunology (906)

- Category (B): Physiology (1248) and Procaryotic Microbiology (713) and lab (432)
- Category (C): General Ecology (652) and Limnology (405)
- Category (D): Extinction of Species (861) and Evolution (601)
- Category (E): Human Nutritional Needs (411) (all others fewer than 200 students)

While the intent of the Breadth Requirement is clear and it makes sense to enforce broad training within biology, some of the particulars appear somewhat arbitrary and can create confusion or difficulties for students, faculty and staff advisors, and administrators.

6.2.4 Options for the BMEC to consider and their advantages and disadvantages:

A. *Keep Foundational and Breadth requirements as they are*. This would require the least effort by Biology faculty and all advising materials and training could remain as they are. However, all the issues identified above (complexity of choices, difficulty in advising & programming DARS, etc.) would remain. In addition, while genetics and biochemistry are clearly basic and cross-cutting fields in biology, it is not clear why they are privileged over other cross-cutting fields. Evolution, for example, also represents a set of concepts fundamental to all of biology and makes extensive use of genetics.

B. *Require both **genetics** (or evolution) and **biochemistry** as Foundational courses.* Requiring Foundational courses in both genetics and biochemistry would be in line with what most Biology students are already doing, particularly for students studying to work in health professions. While this could increase the number of credits required in the major, this impact would be minimal in practice (particularly if the major succeeded in reducing the prerequisite course load by one course). The BMEC might also consider allowing a majors course in evolution to serve as an alternative for the course in genetics. This would allow students more choice, particularly for students more interested in organismal and higher levels of organization. This might reduce the number of students in Genetics 466, but would likely increase the number in Bot/Zoo 410 Evolution. However, there is more capacity in 410 now that it is being offered every semester.

C. *Eliminate the **Foundational** course requirement.* It is hard to know whether the popularity of the genetics and biochemistry courses reflects this requirement or whether most students would likely take these courses anyway (e.g., for pre-health training). To give students and advisors more freedom (and responsibility) the Foundational course requirement could be eliminated and replaced with a simpler combined Foundational and Breadth requirement, e.g., to take 4 courses across at least 3 of the 5 areas (perhaps with two of those involving a lab).

D. *Simplify the **Breadth requirement**.* Currently, this requirement is cumbersome and complex to implement and sometimes confusing. Of particular concern are the current "either . . or" requirements for (A) or (B) and (C) or (D). While the intention here was to ensure that students do not graduate without training in *both* cell/molecular/organismal biology *and* ecology/evolution, this rule has had a perverse effect. The large number of pre-health Biology students seeking to simultaneously satisfy their (C) or (D) and 3 hour / week lab requirement are taking so many places in the majors Ecology course (Bot/Zool 460) that they now crowd out students with specific interests in the subject and students in other majors required to take this course. This situation clearly reflects the scarcity of both lab

courses in (A), (B), and (C) and the relative scarcity of suitable (C) or (D) courses. Giving students greater choice among the categories of Breadth courses while providing more lab courses in (A), (B), and (C) (as per F. below) would relieve the pressure on Ecology 460 and allow students to select lab courses more closely aligned with their particular interests. Breadth is already provided in some measure by the Introductory courses. In addition, students working with advisors may be in a better position to judge which courses best suit their goals. Another way of reducing the pressure on Ecology 460 would be to allow and encourage Biology majors who are not specializing in ecology to obtain credit for taking the non-lab Introductory Ecology course (Bot/Zool 260). Currently Biology students may not receive credit for taking this course (or any course that does not require a year of introductory biology as a prerequisite). Given pressures for (C) courses, however, and the level as which this particular course is taught, we feel that Biology students should be granted credit for taking this course if it is to satisfy the Breadth Requirement. More generally, simpler structures that could provide more choice include options like:

D.1. Combine categories (A) + (B) as well as (C) + (D) to create 3 categories instead of 5 and then require students to take one from each. This would make a course in category (E) (mostly in CALS) required instead of optional, perhaps increasing breadth, while slightly reducing breadth for some students across the (A) – (D) categories.

D.2. Require students to choose a course in any 3 of the 5 categories without regard as to which combinations of these categories are involved. This is similar to option C above. In addition to simplifying the requirement, this option would expand student choice and increase the importance of advising.

D.3. Reduce the number of courses to choose among. A very large number (192) of courses count toward the Biology major. This smorgasbord gives students a broad set of choices and capitalizes on the rich set of course offerings at our university. It may also serve to draw faculty interest to the major and encourage their involvement. However, it also taxes the ability of students, faculty, and staff advisors to stay informed about the curriculum and abreast of its constant changes.

To streamline these requirements, we encourage the BMEC to review and re-evaluate these courses one-by-one. Data from Appendix 9 in the Self-Study shows many courses that are only rarely used by Biology Majors. The BMEC might consider this among other criteria in deciding which to retain. Aside from restricting choice, another potential disadvantage to trimming the number of courses approved for biology is that more students might be seeking places in fewer courses, creating competition for popular courses with limited number of seats. Another disadvantage would occur if dropping these courses discouraged the faculty associated with these courses from becoming involved in the major. For the courses that are retained within the Biology Major, we recommend that IBE or another unit on campus work to extend current efforts like the Biology Course Guide to provide accurate, consistent, and up-to-date descriptions to interested students. These should be available in time for registration and should include enough detail to make clear the differences in approach, content, and level among these courses.

E. *Expand the number of I/A courses available for **Honors** credit.* Despite the large number of courses, several Honors students noted that few of these provide Honors

options, limiting the relevance of the Honors program to Biology Majors as well as their choices for completing the program. The Review Committee thus urges the major to work with departments to foster the development of more intermediate to advanced courses that qualify for Honors credit.

F. *Expand the number of I/A **lab and field** courses available.* The Review Committee noted that departments important to Biology Majors sometimes do not offer such courses (e.g., Genetics) or only a few such courses (e.g., Biochemistry and Zoology). This has created competition among biology students for access to the narrow set of lab/field courses that meet this requirement. Students in the neurobiology and the pre-health fields expressed some frustration on this point. Students in the Neurobiology Option and affiliated faculty, in particular, mentioned the need for one or more additional lab courses in this area. The Self-Study makes clear that the Biology Major is aware of the difficulties that the lab/ field requirement impose and says that the BMEC is seeking to expand the number of courses available to meet this requirement. The Self-Study makes no mention of another problem, namely that biology students have often been tracked into taking courses in areas for which they have only marginal interest (e.g, pre-health students filling seats in General Ecology, then performing poorly). In addition, the large cohort of biology students taking a narrow set of lab courses has acted to restrict access for students with serious interest in particular subjects or in programs that require these courses. Finally, particular new Biology Major Options could benefit from such courses. We support efforts to expand lab and field courses to ensure that more, and more suitable, lab courses are developed and taught regularly. Meeting this need, however, will require resources (see Section 4 below). Lab and field courses are expensive, both in terms of lab space and faculty / TA time. Nevertheless, we encourage the Biology Major to 'flex its muscle' as the largest major on campus and to work with the Deans and departments to do all they can in this regard.

G. *Reduce the lab / field requirement from 3 to 2 hours per week.* One way to quickly expand the number of suitable lab/field courses available to Biology Majors would be to redefine it to include all courses with 2+ hours of lab or field work per week instead of 3. While this is clearly inferior to expanding the number of courses with more substantial labs, it may be more immediately practical. Opening more lab courses would benefit students who would have more choice and could take lab courses closer to their interests (and displace fewer from labs less suited to them). It might also simplify DARS programming in that almost all I/A courses with labs have at least a 2 hour lab. We note that reducing the lab requirement from 3 to 2 hours per week could also create difficulty with the coursework alternative to the Independent Research (699) requirement. Not every biology student can find a 699 or fit it into their schedule. Such students can presently substitute a second 3 hour per week lab for the Independent Research requirement. Thus, reducing the lab course requirement to 2 hours per week means that a student taking two 2 hour/week labs will have fulfilled both the lab course requirement and the Independent Research requirement, reducing standards in the eyes of the Biology Major Co-Chairs. This might be dealt with either by enforcing the 3 hour standard for the Independent Research requirement or by requiring all students using the lab course option to add an additional 1 credit of Directed Study (699) with the instructor (or their advisor) in which they expand on the lab work being done in the course. Either would meet the intent and scale of the Independent Research requirement.

We note that in its current form, the Biology Major does not command the resources to obtain more lab courses, honors sections, etc. That is, while the BMEC can encourage departments to develop or alter courses, it does not itself have the mechanisms (lines of command) or resources (faculty lines) to do what departments routinely do. Thus, if we are to avoid assigning the major another unfunded mandate, we need to address the administrative issues raised in Section 1.

6.2.5 Finding a lab and the Independent research requirement

Biology students eager to work in a research lab have at least two options. First, students in any Introductory Biology sequence may take the new "Entering Research" class (Biology 260 & 261). This IBE course dovetails with 151/152 allowing students to take both if they wish. It is described further at: http://www.biology.wisc.edu/courses/enteringresearchI.asp. Many students in Biology 152 take advantage of the lab option to sign up to do independent work in any biology research lab on campus. Students and faculty were uniformly positive in their evaluation of the value of this program. Students participating in this program often progress to either a paid job or signing up for additional Directed Research (typically 699) or thesis credits, satisfying the *Independent research* requirement within the major. As the Self-Study notes, alumni consider such courses to be the most useful of any they took. In addition, the professional advising staff and individual faculty encourage and guide many students seeking lab positions (e.g., via 'Roadmap' documents with suggestions and expectations clearly laid out). All these programs are a success and should be continued. We also endorse the Self-Study recommendation to establish a central "clearing house" to broker these opportunities.

Several students and advisors, however, were frustrated because some Directed Study credits are being disallowed for satisfying the Biology Independent Research requirement. That is, any Directed Study course that a student takes before that student has finished their Introductory Biology course sequence does not count. The intent of this rule is to prevent introductory students who are entering research work in a lab for the first time (e.g., via the 152 lab project option) from gaining Independent Research credit for this introductory work. Although we support this distinction, we urge the BMEC to explore options to prevent this rule from disqualifying Independent research credit for students doing more advanced research (e.g., for their 2nd or 3rd semester in a lab) who have not yet finished their last introductory biology course (e.g., late-blooming 152 students; this rule only disqualifies 699 credit for Biocore students in their 1st or 2nd semesters). This undesired side effect emerges from the fact that the same course number (<Department > 699) is being used to grant credits for both introductory lab experiences (e.g., a 152 project in the sophomore year) and for more advanced research experiences that satisfy the Independent research requirement. To prevent problems, we ask the BMEC to work with departments to establish clearly distinct course numbers to pertain to each kind of experience. This is already done in many CALS departments that use the 299 courses to apply to introductory lab experiences. The new Biology 261 course number might also be used for introductory research experiences in 152. Directed Study 699 courses could then all be counted toward the Independent research requirement. Professional staff advisors also suggested development of a capstone research course, say Biology 670, which would have clear sign-off by faculty on a research “contract” for the experience. Note also that CALS

has a beefed up Capstone requirement that subsumes and goes beyond the Biology Major's Independent research requirement.

6.2.6 Options within the Biology Major and links to existing majors

When the Biology Major was originally designed, it was expected that the broad set of rigorous prerequisites and other requirements would prepare students to enter any of a variety of existing majors in both L&S and CALS later, when they had more of an idea about their particular interests and career goals and a better sense of the many particular departmental majors. Instead, we have observed that most Biology Majors prefer to remain in this degree program. It was also anticipated in developing the Biology Major that a number of formal Options would develop, particularly in areas where no existing departmental major existed. In fact, two such Options have been developed – one in **Neurobiology** and the other in **Evolution**. These have proved popular with the biology students that have chosen them, helping these students to develop competency in their chosen sub-field and enhancing the sense of community among students and faculty in these areas. However, adding Options requires resources in terms of faculty time/commitment for advising and specialized seminars, and, potentially, course resources in terms of additional I/A lab/field courses or sections.

Given the demonstrated success of the Neurobiology and Evolution Options, the expressed interest of several of the students we interviewed, and our charge to explore actions to help enhance feelings of community within the Biology Major, the Review Committee feels that the Biology Major and its students would benefit if more Options could be offered. Members of the Executive Committee, faculty advisors, and students generally agreed that more Options would enhance student choice and benefit the major. The existing Options both cover subject areas that have campus-wide identity and organization but lack a departmental major. Additional Options in areas like **Behavior**, **Bioinformatics** or **Ecology** could also be readily instituted by taking advantage of existing cross-campus self-identified groups in these areas to design and administer the Options. It also makes sense to consider an Option in **Biology Education** in light of the recent elimination of the School of Education major in this area. Given the existing cross-college majors in Molecular Biology and the Biological Aspects of Conservation, there is little incentive to develop Options in either of these areas.

It might also prove feasible and effective to develop additional Options even in areas with existing departmental majors such as **Microbiology** (designed in collaboration with the Bacteriology and Medical Microbiology and Immunology departments) or **Plant Science** (designed in collaboration with the departments of Agronomy, Horticulture, Plant Pathology, and Botany). (There were, in fact, efforts in the 1990s to develop a Plant Science major that faltered due to a lack of shared vision and curriculum.) Such Options could prove popular and take effective advantage of courses in a number of departments.

If additional Options close to existing departmental majors are developed, it will be important to proceed carefully and with sensitivity to the concerns and desires of those departments. Some departments may view the development of such Options as a potential threat to maintaining their own independent majors. It is also possible, however, that creating more Options could widen the "catchment basin" from which departments might recruit biology students into their own departmental majors. That is, some new Options might act as paths into existing specialized majors by advertising their existence.

Alternatively, creating new Options within the Biology Major might serve students and the university well by providing an efficient alternative to maintaining some of the many small conventional majors. Under this "Cornell model", many departments give up their individual majors in exchange for a greater role within the Biology Major. The roles of these departments are proportionately greater within the specialized Option that replaced their major, allowing them to retain identity in terms of their student-faculty community. It would also free them to commit faculty advisors to the Biology Major and 'claim' graduates and alumni for later fund-raising.

Re-inventing and streamlining the Biology Major by adding Options in this way could align well with the new “Education Innovation” project promoted by Chancellor Ward. Specifically, combining or eliminating majors would simplify choices for students bewildered by the diversity of biology majors on campus while easing the burden on advisors seeking to master their requirements. It could also provide students with a core experience in their first two years, allowing them to then specialize by pursuing Options "owned" by faculty and sometimes departments and/or groups of departments. Coordinating advising and providing a uniform path for undergrads in their first two years could bring efficiencies as well as a more cohesive experience for the students. Reducing the number of sometimes redundant majors on campus and simplifying choices for students among Options could also serve student interests while perhaps saving resources. Potentially, these efficiencies might allow departments and colleges to save or recover faculty positions. The administration thus has a key role to play here in encouraging cooperation and collaborations among faculty and departments rather than allowing historical structures to stand.

At a time when even popular majors like Medical Microbiology and Immunology are being eliminated, we should be seeking economies of this kind among smaller majors. The downside, of course, in the views of these departments will be their reluctance to lose autonomy or a proud historical tradition as well as less direct connections to loyal alumni for development work. Given these concerns, it will be important for deans and colleges to work with the Biology Major to develop suitable incentives for departments to work cooperatively and collaboratively with this large major.

6.3 Recommendations:

- Establish formal or informal liaisons with the Departments of Math, Statistics, Chemistry, and Physics to encourage the development of **prerequisite course content** and/or course sequences particularly suited to Biology Majors.

- Consider streamlining/reducing the math/chemistry/physics **prerequisite requirements** if new or modified courses in those departments allow this (e.g., by covering content in one semester formerly covered in two).
- **Introductory Biology** - Encourage more students with suitable scores on the Advanced Placement test in biology (4 or 5) to place out of Biology 151 and enroll directly in 152 or the Biocore sequence.
- Continue to encourage and incentivize students in 152 and other Introductory Biology activities to work in research labs for academic credit. We support the Self-Study recommendation to establish a central "clearing house" to broker these independent research opportunities.

- Encourage the use of 299 for beginning level independent research experience (such as in Biology 152). This will require course number additions in several departments not in CALS. Such 299 addition and elimination of using 699 for beginning level research will alleviate the current confusion and DARS problems with the independent research requirement.
- Given the wide array of course options in the Biology Major, support and extend efforts to provide accurate, consistent, and up-to-date descriptions for biology courses to interested students. Make these available for registration and make clear the differences in approach, content, and level that exist among these courses.
- Review and re-evaluate the specific Foundation and Breadth requirements in the Biology Major. For the **Foundation**, consider requiring a course in both genetics (or evolution) and biochemistry. Alternatively, eliminate this category and require more credits under Breadth.
- For the **Breadth** requirement, consider a range of options to avoid the complex "either/or" structure, e.g., by moving to a simple "any 3 courses out of 5 categories."
- Review and consider trimming the long list of 192 approved I/A courses.
- Work with departments to develop more I/A **lab and field courses** to meet that requirement and the needs of particular areas and Options (including fields related to biomedicine)**.**
- To expand choices, reduce bottlenecks, and simplify advising and DARS programming, reduce this requirement for these courses from 3 hours of lab or field work per week to 2 hours.
- Work with departments and the Honors program to offer more I/A biology courses for **Honors** credit.
- Develop more intermediate and advanced **lab and field courses** to meet that requirement and the needs particular areas and Options.
- Establish additional Option**s** within the Biology Major to complement the two that exist, enhance feelings of community, and expand options for students wanting to specialize. These should start with areas where suitable umbrella groups but no departmental major exists. They might also extend to encompass cooperating departments and programs, perhaps eventually eliminating one or more existing majors.
- Develop **incentives for faculty and departments** to work cooperatively and collaboratively with the Biology Major to develop these needed courses, lab sections, and Options.