A. Introduction

Biology has become the dominant science at the beginning of the 21st century: advances in biology will be essential for solving many of the world’s most challenging problems, ranging from defense against bioterrorism to ecosystem degradation. The mission of the College of Biological Sciences is to cultivate and communicate these scientific breakthroughs by providing high quality education and research programs from molecules to ecosystems.

To accomplish our mission, we integrate strong basic research programs with innovative teaching and intensive mentoring of students.

The College of Biological Sciences (CBS) is a champion for curiosity-driven research in the core disciplines of biology. Research accomplished by our faculty has a major impact, often influencing entire fields of inquiry to turn in new directions.

CBS is organized with the following major units:

Department of Ecology, Evolution and Behavior
Department of Biochemistry, Molecular Biology and Biophysics (joint with Medical School)
Department of Genetics, Cell Biology and Development (joint with Medical School)
General Biology
Department of Plant Biology
Biotechnology Institute
Student Services
Office of the Dean

CBS is responsible for undergraduate education in introductory biology and in the core biological disciplines. CBS offers seven bachelor of science degrees: Biology; Biochemistry; Ecology; Genetics, Cell Biology and Development; Microbiology; Neuroscience; and Plant Biology. In addition to providing high quality education for students majoring in these disciplines, the College also provides classroom, laboratory, and field experiences for students from other majors at the University of Minnesota, including agriculture, engineering, health sciences, liberal arts, and natural resources.

CBS is a collegiate partner in graduate education leading to masters and doctoral degrees in ten biological disciplines: MBS, the professional masters program in biological science; Biochemistry, Molecular Biology and Biophysics; Conservation Biology; Ecology; Microbiology, Immunology and Cancer Biology; Molecular, Cellular, Developmental Biology and Genetics; Neuroscience; Plant Biological Sciences; Microbial Engineering; and Genetic Counseling. The faculty of CBS serve as mentors in the MD/PhD Program and in the Joint Degree Program in Law, Health and the Life Sciences. CBS faculty are also significantly involved in several other graduate programs across the University.

A new graduate minor in Bioinformatics has been approved and is now being offered through a joint effort between CBS, the Medical School, and the Institute for Technology.

The faculty and staff of CBS provide expert service and outreach to the state of Minnesota, the nation and the world. For example, members of our faculty and staff work closely with the community and other educational institutions to promote science education. Members of the college actively participate in the worldwide community of scientific peers, serve in the leadership roles of professional organizations, and contribute to the administration and governance of the University. Since basic research is often translated into solutions by organizations outside of the University, the college is committed to developing partnerships with industry and other for-profit agencies.

The compact between the Senior Vice President for Academic Affairs and Provost and the Dean of the College of Biological Sciences for 2004-05 includes the following:

B. Update--Major Long-Term Goals/Priorities from Previous Compacts

The goals of “Improving and Expanding the Undergraduate Experience” and “Improving Graduate Programs in the Core Disciplines of Biology” have been rearticulated in the following section. The college is also making more explicit and deliberate its goal for the department of Ecology, Evolution and Behavior.

1. Maintain and improve the excellence of the department of Ecology, Evolution and Behavior

The department of Ecology, Evolution and Behavior (EEB) is recognized as one of the elite departments at the University of Minnesota with nationally renowned faculty and an excellent graduate program. In the past several years, the department has experienced a significant turnover, with a number of junior faculty now part of EEB. To continue its current strengths and to
achieve broader prominence in all areas represented in the department, one faculty member each in behavior and in evolution will be hired during 2004-05. The behavioral laboratory renovation will need to occur to attract and support the faculty in behavior (see more details in facilities section below). The department will also add two graduate TA positions to staff several labs/recitations of core courses that are currently run by undergraduate students. In addition, EEB plans to expand the interface between civil engineering and ecology, and to this end, is submitting an IGERT proposal to NSF this April for interdisciplinary training of graduate students. (Decision about the proposal will be made April, 05.)

The head of EEB is a nationally distinguished expert in the interface between mathematics and biology, and will help provide leadership in developing Computational Bioscience, the twin disciplines of bioinformatics and computational biology. Details of our plans in this new endeavor are found in Section C, New Long-Term Goals/Priorities. With the help of the head of Plant Biology, EEB leadership is also guiding faculty dialogue on Molecular and Microbial Evolution, which is also elaborated upon in Section C.

Finally, we are exploring mechanisms to more substantively connect the behavioral biology branch of this department with behaviorally and neuroscience-oriented colleagues at the University. In particular, we are attempting to identify both near and long-term strategies for providing contiguous, state-of-the-art laboratory and office space for behavioral faculty from several departments on the Saint Paul campus.

Measures of Success:

- 2 new faculty on board for 2005-06 academic year.
- 2 new graduate TA positions filled.
- Implementation of NSF training grant or resubmission of revised one.
- Implementation of near term space strategy for behavioral biology (October 2004); agreement on long-term strategy and identification of resources to implement (January 2005).

CBS is dedicating two recently vacated salary lines to the faculty positions, $20,000 to 30,000 in search costs, and $40,000 (recurring) for two part-time teaching assistant positions.

Graduate education is the *sine qua non* of the University of Minnesota’s research and educational mission and is critical to the College of Biological Sciences and the Medical School’s basic science enterprise. It is the work of graduate students that enhances the research of faculty and the quality of undergraduate education. Current graduate students are also increasingly involved in outreach, working with local museums and schools, for example. Successfully educated graduate students sustain the academic workforce in higher education, recruit their colleagues to become part of the “creative class” in Minnesota, and increasingly contribute to the leadership of a vital regional economy. Graduate students become the entrepreneurs for start-up companies, the executive leadership of corporations, and hire University alumni with baccalaureate degrees.

The quality of graduate programs is so important that the National Research Council ranking of doctoral programs is generally interpreted as the most reliable and highly reputable measure of academic departments and research universities. Based on conversations with colleagues at major public research institutions, competition for highly talented graduate students is increasing and will certainly determine the true strength and reputation of graduate programs in the basic sciences. The Twin Cities Academic Deans have discussed this situation and have made support of graduate education a top goal in their list of academic priorities.

The college achieved several of its goals for graduate education articulated in the 2003-04 compact, such as conducting a program review of MCDBG and BMBB and their combined entry program, Molecular and Cellular Biology (MCB), and ensuring the continuation of BSCF funds for Plant Biological Sciences and for the MCB Itasca program. (The Itasca Program for newly recruited graduate students is a hands-on immersion experience featuring orientation, seminars, and laboratory learning.) The program review for Plant Biological Sciences occurred this spring, and external reviewers observed that Plant Biology is on track to becoming one of the best 10 such programs in the country. CBS is working closely with the College of Natural Resources to clarify and adjust tuition income regarding Conservation Biology and the Water Resources program. Some goals were only partly achieved or postponed due to financial constraints: we are continuing our commitment to increases in TA stipends for Ecology, Evolution and Behavior and Plant Biological Sciences and we intend to reallocate General Biology TA positions more equitably among our departments for fall, 2004.

The Itasca program for Plant Biological Sciences has been postponed until resources can be identified.

2. Strengthen Support for Graduate Education
The external reviewers of the BMBB and MCDBG programs illuminated an issue which was not previously appreciated: all the graduate programs in CBS and those joint programs with the Medical School have a smaller Ph.D. student/faculty ratio than those at competitor institutions. While the graduate programs are built on multi-departmental and multi-collegiate faculty, they rely predominantly on funding by the “core” departments and their colleges. All programs need to build and grow in numbers and quality.

A major impediment to maintaining current quality, much less growth, is financial support of first-year graduate students. Departments bear the costs of recruiting and the Itasca programs, while support for individual students relies on soft salary release dollars from a variety of sources. EEB students are often supported in their first year through Graduate School Fellowships. Subsequent support is more challenging since EEB students traditionally develop their own independent research programs and are not often funded on their advisor’s research grants. All this is contributing to structural financial deficits in the departments. The U of M pays more than 50% higher fringe benefit costs for graduate students than its competitors, at least during the first 3-4 years, due to the combination of high health benefit costs, high tuition rates, and a requirement for thesis credits. This high level of fringe benefits makes our graduate students much more costly both for the departments (during much of the first year) and the faculty whose grant must bear the added expense.

Issues vary among the departments. For the departments joint with the Medical School, federal guidelines are leading to an increase in stipends resulting in additional pressure on grants and on departmental first-year funding. In order to help relieve departmental expense, current faculty are expected to pay for rotation students on grants (with a partial pay-back), a new practice that adds often unplanned costs to grants and may raise federal compliance concerns. The higher cost for grant-supported graduate students is causing some faculty to consider hiring more post docs and fewer students.

Ecology, Evolution and Behavior, which relies heavily on TA-ships for support of students, provides lower TA and RA stipends than competitors. There is increasing pressure from federal guidelines (e.g., NSF) to raise stipends, and EEB is witnessing the creation of a two-class system—those who are well funded on grants and those funded on cheaper TA and RA-ships. Twelve-month NSF Research Fellowship stipends, for example, are $27,500 for 2003-04. Nine-month graduate school fellowships for incoming students will be $16,000 in 2004-05. Plant Biology also provides low stipends for TAs, and could pay higher for grant-supported RAs, but prefers not to create a two-class system of TAs vs. RAs.

**Goals:**
- Obtain more comprehensive comparative data on graduate support at competitor institutions; determine level of central university/graduate school support and that provided by collegiate units.
- Stabilize funding for current programs in terms of TA allocations, stipend levels and operational costs. CBS and the Medical School will provide resource stewardship by working with department heads and relevant Directors of Graduate Programs.
- Develop 5-year plans for expansion of programs, utilizing results of program reviews and the MCB initiative review. Increase the number of new graduate students recruited in all departments.
- Raise expectations for graduate student success as program quality is enhanced.

**Measures of Success:**
- Evaluate competitor data by April 15, 2005.
- Create new graduate program support lines in departmental budgets for 2005-06.
- Develop new plans for program growth and student success by May 30, 2005. Plans will include ways to ensure specific levels of quality in recruitment pools.
- Request new allocation of financial resources as part of the 2005-06 legislative request.

Graduate Student support and funding is extremely important and is being addressed on a University-wide basis. The Senior Vice President for Academic Affairs and Provost has charged a task force to examine this issue. In addition, CBS has submitted a financial strategy to the Provost to stabilize financial support of CBS graduate programs.

### 3. Enhance Undergraduate Education

CBS will serve University of Minnesota students by delivering a challenging and coherent curriculum that reflects the complexities of today’s biology and prepares students to understand and discover the biology of the future. This goal will be achieved through curriculum reform and development of a comprehensive enrollment management strategy that includes targeted efforts...
for improvements in our recruitment of students as well as our retention and graduation rates.

Curriculum Reform  Our desired outcomes for undergraduate education include preparing CBS graduates for life-long learning and success, developing biology literacy in the non-majors who enroll in our courses, and becoming recognized as a national leader in undergraduate biology education innovation and success. In the Fall of 2003, we convened a Curriculum Task Force comprised of faculty from all departments offering an undergraduate major. The Task Force objectives are to define CBS’ educational goals, examine our current curricula and teaching laboratories, make recommendations for desired improvements, and develop strategies for achieving the proposed changes. A result of this work will be a shift from content-driven to an outcome-based curriculum and teaching strategies, with established metrics for assessment of courses, faculty, and students. To date, the task force has developed and presented learning outcomes for CBS graduates at the All-College Meeting in late fall, 2003. We are presently seeking faculty and student input about our current curriculum (including from other colleges within the U of M and other institutions), developing a course audit, and examining our courses and teaching laboratories in the context of our educational goals. The task force has already recommended a change in structure of the first two years of CBS students’ academic experience. A renovation of teaching laboratory facilities will be needed to support these changes, and more is described in the facilities section below.

Advising  An important component of retaining and graduating students is an effective and efficient advising system. CBS has hired a permanent director to lead its Student Services office and advising services. One of the unique challenges facing CBS is division of administrative and student support offices between the Minneapolis and St. Paul campuses. Advising is located in St. Paul, while the majority of our students live and attend classes in Minneapolis. To increase our ability to serve students, we must have an advising presence in Minneapolis. Consequently, we will develop technology to allow our staff to access student files and records when in Minneapolis. A variety of web-based advising tools are currently in use at the U of M, including those used by CLA, General College and the Office of Admissions and we are studying these models to determine which best fits CBS. The implementation of such a system will require non-recurring funds.

Once the tools are in place to offer off-site advising, we will also need appropriate space to provide advising services to students in Minneapolis. We have identified suitable space but it will require renovation to create private office space and equipment to serve students. In addition, because the space is near the Health Careers Center, these changes will enable us to continue to develop strong synergies with the Academic Health Center to provide health sciences career advising.

Scholarship Development  Undergraduate scholarships are a top collegiate priority for fundraising efforts. There exists an urgent need to secure adequate scholarship funds for CBS to attract the best and brightest students. CBS is in the process of hiring a new Development Director and once this individual is hired, goals and a fundraising strategy will be developed to secure additional scholarship dollars for undergraduates.

Measures of Success:
• Undergraduate learning outcomes will have specific methods of measurement by 2006.
• Curriculum Task Force will have completed review of courses by March, 2005, and will have developed recommendations for modification to a new curriculum by May 2005.
• Technical access to advising data will be made available to advising staff by April, 2005.
• A full advising system, with adequate facilities in Minneapolis, will be established on the Minneapolis campus by Spring 2006.

Proposed for FY 2004-05

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<th>Item</th>
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<td>NRC Summer Institute for key Task Force members</td>
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<td>CBS Conference on Undergraduate Education</td>
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<td>Faculty Support for curriculum grant submission</td>
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<td>Electronic Student Records Technology</td>
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Other contribution: $200,000 for Advising Space Renovation (see section G1 below)

RRC contribution: $15,000 for CBS Conference on Undergraduate Education

Central contribution: The Provost is committing $50,000 nonrecurring in support of the electronic student records piece toward the college’s request for a total of $245,000 to support student records and faculty development.
The college will re-think the proposed programs above for the 05-06 academic year, given budget constraints in CBS and the University.

C. New Long-Term Goals/Priorities

1. Make significant contributions to the Presidential Initiatives.

   a. President’s Interdisciplinary Initiative on Biocatalysis

CBS aims to utilize its resources and potential to help ensure that the President’s Initiative in Bioscience and Biotechnology creates a highly productive, interdisciplinary program that will bring national distinction to the University of Minnesota. It is vital that the U remain a center for cutting-edge basic research, an innovative laboratory for applications of basic research, a magnet for the highest level of talent, and an educator of the next generation of bioscience and biotechnology workforce. The University has strong programs in biochemistry, genomics, chemistry, and plant biology. As a result of President Yudof’s Initiative in Molecular and Cellular Biology, the University has significantly strengthened basic science programs in these areas.

Within these programs and others in COAFES, the medical school and IT, there are groups of excellent faculty who are practiced at working collaboratively and excited about the commercial potential of their work. The University’s new, state-of-the-art facilities, including Biodale, the Biotechnology Institute, the Molecular and Cellular Biology Building, and the Cargill Microbial and Plant Genomics Building, have been important resources in attracting new faculty, start-up companies, and established industrial collaborators to the University. Given Minnesota’s scientific strengths, agricultural resources, and companies already active in exploiting biocatalysis, the University is poised to establish itself as the hub of biocatalysis-based industry, just as California and Massachusetts have pursued leadership in other areas of biotechnology.

The development of the biotechnology industry in Boston, San Francisco, San Diego, and North Carolina, however, is proportional to the number of PhD graduates in those areas. PhD’s are intellectually capable of developing new industries, starting companies and spinning out new opportunities. At the University of Minnesota, the engineering disciplines graduate large numbers of PhD’s, but the biological sciences produce by comparison only a trickle. To strengthen the biocatalysis and biotechnology private sector in Minnesota, and to develop bio-based jobs and companies, we need to markedly expand PhD production as we discuss below in our goal regarding graduate programs.

CBS is in a position to provide leadership through its expertise in areas of microbial genomics, metabolic engineering, plant genomics and biochemistry, including relevant expertise in nutrient acquisition (e.g. carbohydrate and iron) and responses of plants to pathogens and their interaction with beneficial microbes. Through this initiative, the college hopes to strengthen research in (1) systems biology, which incorporates computational tools to understand complex patterns regulating metabolism and gene expression patterns, (2) biosynthesis of natural products that can be used in applications for healthy foods (e.g. antioxidants), pharmaceutical (chemotherapy agents and anti-microbials), biomaterials as substitutes for petroleum-based products as well as bio-based strategies for renewable energy, (3) this initiative will also enhance training of students in cutting edge techniques in fundamental and translational research.

The foundation for this initiative could be termed the “Stan Dagley School of Microbial Metabolism” in which we have historically invested resources. The Microbial and Biotechnology Division of our Department BMBB and Biotechnology Institute are built upon this intellectual platform. CBS will further invest in this important area by hiring new faculty members in EEB, BMBB and Microbiology during 2004-2005.

The Graduate School, acting on behalf of the participating colleges as the lead unit for the President’s Initiative in Biocatalysis, submitted a request for funding for fiscal year 2004-05 and received $370K recurring and $30K nonrecurring. The participants plan to use these funds to establish research collaborations among groups with differing expertise, basing these collaborations on the new scientific platforms (e.g., combinatorial libraries, proteomics, bioinformatics) that are revolutionizing biological science and providing the opportunity for the translation of biological discoveries into economically promising products and processes. Funding will be used for personnel (graduate students, postdoctoral fellows and technicians) to bridge between faculty research groups to carry out the collaboration and for maintenance and utilization of the technology platforms.

A bigger investment here could be part of the solution to enhance support of graduate students in CBS and the Medical School, the challenges of which are articulated in another major goal of the college below.

1 Stanley Dagley was Regents’ Professor of Biochemistry from 1970 – 1987.
b. President’s Interdisciplinary Initiative on the Environment and Renewable Energy

A major accomplishment for CBS and the entire U of M last year was the legislature’s award of 20 million dollars over 5 years to support research on energy and the environment. CBS has worked closely with COAFES, IT, and the HHH Institute to develop the Initiative on Renewable Energy and the Environment (IREE), and faculty from other campuses and collegiate units are becoming increasingly involved. The synchronicity of available funds from the Xcel Energy funds and the capacity of many researchers and scholars across the University to harness these funds is exceptionally timely. The renovation of research and housing facilities at the college’s Cedar Creek Natural History Area and the Itasca Biological Station and Laboratories (see below) will enhance the research and demonstration project opportunities made available through this funding.

Since the funding was awarded, much has been accomplished. Four IREE Clusters are functioning, led by 14 Cluster Co-leaders representing 6 colleges and 13 Departments/Units. Colleges currently represented on IREE Executive Committee, Cluster Co-Leaders, or on funded projects include CALA, CBS, CNR, COAFES, CSOM, HHH, and IT. IREE funding processes (funding categories, investment principles, proposal submission/review) have been implemented. To date IREE has funded 21 Seed Grant proposals totaling $606,000, involving 61 Faculty, 11 industry partners, 6 partners from other Universities, and 5 external agencies. Two IREE Matching Grants have been approved totaling $150,000. The resulting awards have leveraged $33,000 in other University funds and $776,000 in external funds. Two additional IREE Matching Grants have been approved which, if awarded and fully leveraged, will result in $12 million in external funds. Two IREE Special Opportunity Awards totaling $150,000 have leveraged $1.7 million. The University of Minnesota Renewable Energy Research and Demonstration Center at Morris is under development, with $3 million obligated.

Full descriptions of these projects can be found at http://www1.umn.edu/iree/. A sample of these projects is found in Appendix A.

Communications activities include the development of the IREE website, promotional materials, and an IREE Communicator’s Council. Outreach activities include IREE symposia series, significant partnering with various external entities including USDOE, NREL, USDA, local industries (Cargill, 3M, Xcel, Entegris, etc.), local NGOs (ME3, MEI, UMHI, MN Science Museum, etc.) state agencies (MDA, Commerce, DEED, OEA), and state initiatives (MN Renewable Hydrogen Initiative, MN BioFiber Consortium, CERTS). The IREE External Advisory Committee is being formed and we are very pleased to report that IREE is achieving growing national recognition. This recognition is based upon the requests from the federal Department of Energy, and in particular the National Renewable Energy Laboratory, for establishing and growing substantive research partnerships at an institutional level.

As a co-leader on this presidential initiative, the college is also working with CNR to develop the University’s potential in environmental policy and environmental education. A planning grant of $20,000 has been awarded to help assess current curriculum in regard to a potential sustainability minor, and to assess ways the University can offer a unique service in terms of policy analysis and recommendations, on the local, state and national levels. We are also involved in an effort involving ecosystem science education and a request for funding to an external agency has been made in this regard.

This initiative also includes the University’s Sustainability and Energy Conservation Policy Work Group, led by Vice President for University Services, Kathleen O’Brien. CBS leadership participates in this effort through occasional consultation related to IREE activities.

Goals:
- Sponsor or co-sponsor 12 public meetings/forums.
- Identify strategic investment areas for IREE funding through seed grants and matching or special opportunity grants.
- Establish and convene an IREE External Advisory Committee.
- Complete and implement permanent IREE staffing plan.
- With CNR, ascertain viability of academic minor in Sustainability.
- With CNR, delineate specific and unique strengths the University can utilize in environmental policy; determine feasibility of new organizational structure to improve resource utilization and regional or national impact.

Measures of Success:
- Awarded seed grants and matching or special opportunity grants strategically by spring, 2005.
- Permanent IREE director and staff in place summer, 2004.
- Determine viability of Sustainability Minor by winter, 2004.
- Unique U of M contributions to development of environmental policy created by spring, 2005.
c. Other Presidential Interdisciplinary Initiatives

CBS is involved in The Consortium on Law and Values in Health, Environment and the Life Sciences through annual support of $20,000. The college leadership also participates in the guiding committee for The Brain Function Across the Lifespan. The college is seeking creative ways to make its expertise available to the Translational Research in Human Health Initiative and to the Healthy Foods/Healthy Lives Initiative. In the case of the former, our faculty in the Beckman Center for Transposon Research in GCD have proposed to participate in a cluster hiring effort with clinical departments (Medical School and College of Veterinary Medicine) so as to expedite clinical trials using a transposon-based approach for gene therapy.

2. Develop New Intellectual Platform for Biological Sciences at the University of Minnesota.

a. Microbial and Molecular Evolution

The department of Ecology, Evolution and Behavior has initiated a brown bag lunch series to summarize existing strengths in microbial and molecular evolution, to determine objectives for enhancing interactions in the molecular evolution community, and to bring ideas to the community that appear promising for new major initiatives within CBS. The genomics revolution has opened an incredible array of opportunities for research at the biochemical and organismal level, in areas as diverse as microbial ecology, biocatalysis, biodegradation, phylogenetics, drug design, and metabolic pathway analysis. Evolutionary biology provides the common language to enable synthesis of disparate genomics projects.

The University of Minnesota has considerable expertise in microbial and molecular evolution. In addition to individual faculty’s research programs, two centers are devoted to microbial and plant genomic research and one center to the study of community genetics. The Center for Microbial and Plant Genomics in the new Cargill Building fosters campus-wide collaboration for the successful development and application of genomics research including the study of its societal and ecological impact. The Center for Microbial Genomics promotes studies on genome analysis of micro-organisms and houses the Biocatalysis/Biodegradation database. The Center for Community Genetics is devoted to the study of community interactions in an evolutionary and ecological context and provides interdisciplinary training opportunities for graduate students.

Most research focuses on single organisms or small groups of organisms. The increased availability of genomes of diverse organisms provides new opportunities in comparative genomics and the study of evolutionary diversification, such as metagenomics, the large scale genome analysis of microorganisms in the environment that cannot be cultured, or the elucidation of the evolutionary history of metabolic pathways in diverse organisms. This will require synthetic work combining genomic and biochemical approaches with ecological and evolutionary processes that can only be done by groups of researchers.

By the winter of 2005, CBS will have a clear view of how the University of Minnesota can establish a niche in this area in comparison to what is developing at other institutions across the country.

b. Computational Biosciences

The recently published NIH Roadmap has identified Bioinformatics and Computational Biology as targets for investment and explicitly has asked how best to establish these twin disciplines within America’s colleges and universities. In the present context, we propose to link these two fields as “Computational Bioscience.” CBS intends to lead the dialogue and coordination of this interdisciplinary work in conjunction with the Institute of Technology, the Medical School, the School of Public Health, COAFES and CVM. In fact, the logical long-term home for coordinating these efforts may be the Digital Technology Center.

Investments made in the Molecular and Cellular Initiative have helped create the emerging foundation of computational bioscience across several collegiate units. The 41 new faculty members hired under the MCB Initiative have strengthened the University’s capacity to utilize tools of genomics to understand the fundamental function, organization and expression of genetic information in many organisms. This has resulted in a rich diversity of research projects on many biological systems, such as microbes, model organisms (animal and plant), crops, and humans. An important next step is to identify tools and expertise needed to move from this platform of basic scientific understanding to deliverables outlined in the President’s proposed initiatives. Specifically, development of Computational Bioscience is a key to realize the full scientific potential of initiatives such as Biocatalysis, Translational Research for Human Health, Healthy Foods/Healthy Lives and the Environment and Renewable Energy. Proteomics and computational bioscience enable identification of genes contributing to complex traits, such
as enhanced nutritional qualities of crops, resistance/susceptibility to disease (plant, animal), or ability to degrade or sequester environmental pollutants.

As illustrated above, continued investments in other, foundational sciences (Proteomics, Microbial & Molecular Evolution) are also required as a sound intellectual and service platform for the success of these initiatives.

One of several discussions in Computational Bioscience has been convened by faculty from several colleges on the Saint Paul Campus. A description of their strengths and needs follows. CBS, as the only college with major activities on both campuses, is eager to see this effort extend into a comprehensive, university-wide approach.

St. Paul campus faculty have realized that although genomic data is applied to different ends in different units, the requirements for data mining are similar. The St. Paul Campus, as a home to diverse genomics projects in plants, microbes and animals, provides a collaborative atmosphere for developing bioinformatics. This is fostered by the Center for Microbial and Plant Genomics, which is anchored in the new Cargill building and draws members from CBS, COAFES and CVM. Extensive collaboration between COAFES and CVM in animal genomics round out the genomics expertise in St. Paul. Moreover, the new Computational Genetics Laboratory (CGL), run by the Minnesota Supercomputing Institute, and sited in the Cargill building, is already providing software support and basic bioinformatics training.

At this point in time it is envisioned that the bioinformatics program will focus on three broad areas: 1) project development and implementation of new applications (programming for efficient data mining), 2) teaching and training (undergraduate and graduate students, and faculty when necessary) and, 3) research. As next steps towards building bioinformatics in St. Paul, faculty have reported that preliminary needs include support of professional staff to aid in project development and implementation of new applications, and support for faculty hires in bioinformatics, specifically for non-recurring funds to be put towards set-up costs of new faculty hires in this area.

The educational component of Computational Bioscience is equally critical, and CBS faculty have already taken action with several initiatives. Because the field of computational bio science has emerged at the intersection of biology, mathematics and computer sciences, the enhancement of graduate training opportunities in this area provides many opportunities for interdisciplinary interactions among faculty. Currently, a group of CBS faculty (in EEB, PBio and BMBB) is exploring the potential for a training grant in computational analysis of biological networks, together with colleagues in Mathematics, Computer Sciences and Engineering, and CEMS. The group is seeking support for a pilot project, including a year long seminar course, with a goal of seeking extramural support for an interdisciplinary training grant. In addition, individual members of this group are seeking opportunities for co-advising graduate students with faculty in IT.

CBS faculty have also initiated the Bioinformatics Summer Institute (http://www.bsi.umn.edu/), an NIH/NSF sponsored summer program entering its second summer at the University of Minnesota with faculty from CBS and IT. This program recruits upper level undergraduates from both the biological sciences and computer science for a 10-week program that includes classroom instruction, hands-on workshops, and participation in individualized research problems. There are 70 applicants from the U of M and universities across the country for 16 slots this year and students admitted are of the highest caliber.

This program could serve as a model for expanding computational bioscience instruction for undergraduates because of the rich database of evaluative information and the very effective use of undergraduates in interdisciplinary research.

During the remainder of 2004-05, CBS will investigate how these activities are coordinated across the University and where investments could be made to exploit the talents of current University faculty and build upon our research strengths.
c. Proteomics

The department of BMBB (a partnership of CBS and the Medical School), has taken the lead among U of M entities in the rapidly emerging field of proteomics. Several faculty from BMBB are nationally recognized protein biochemists and thereby provide depth in the intellectual underpinnings of the technologies that enable proteomics research. Historically, the development of proteomics at the U of M began in the mass spectrometry facility in Biodale and has been funded by competitively obtained shared instrumentation grants secured by BMBB faculty from NIH and NSF, with matching funds from CBS, the Medical School, COAFES, and the Office of the VP for Research. Recently, a major expansion has occurred on the Minneapolis campus in the Molecular and Cellular Biology building, largely funded by resources from the Medical School. Finally, new faculty have been hired under the auspices of the Molecular and Cellular Biology Initiative. These efforts have been complemented by the creation of the protein expression and purification facility at the Biotechnology Institute. All these resources have enabled faculty from several units to extend their research programs into proteomics as evidenced by new grants and publications.

Based on this strong platform, goals for the future include deepening the expertise of current faculty from across the University through workshop-style programs, using the current faculty expertise and technology to recruit new faculty, and contributing significantly to the development of new tools for proteomic research. Given the wide span and impact that proteomics will have, we request that University investments be planned in a manner that coordinates and builds upon the platform that CBS and the Medical School have built.

D. Diversity Assessment and Planning

1. Undergraduate Students

It is a CBS priority to increase the diversity among our entering first-year class. In Fall 2003, 17.1% of our undergraduates were students of color, an increase from 14.5% in 1999. While we are pleased that there is a growing population of Asian American students in CBS, the college will increase its efforts to recruit and retain students from other under-represented groups. Working in cooperation with the Office of Admissions, CBS will develop a comprehensive plan for increasing diversity by June, 2005.

Measure of Success:
- Increase students from under-represented populations from 17% to 20%.

2. Graduate Students

In last year’s compact we described ongoing and proposed efforts to improve the diversity of our graduate programs. Here is an update on last year’s activities and plans for the remainder of this year and the next.

With the help of the Graduate School and in conjunction with IT and the Medical School, we have solicited the assistance of the Omicron-Boule’, a local organization of African-American businessmen, to become involved in our summer undergraduate research programs as a means of improving our recruitment of students of color into our graduate programs. In the summer of 2003, several Life Sciences Summer Undergraduate Research Program (LSSURP) students and students from other summer programs were hosted by members of Omicron-Boule’ at local companies. We continue to restructure and refocus the LSSURP program to increase the numbers of LSSURP participants who enter U of M graduate programs, with these strategies for 2004-05.

- Finalize a communications plan targeted at external institutions and students, and internal programs and individuals to raise awareness and utilization of LSSURP. Plan to be completed by September, 2004.
- Convince the graduate school to establish an automatic application fee-waiver system for LSSURP participants.

4. Biotechnology in Southern Minnesota

During 2004-05, in partnership with the Worthington Regional Economic Development Corporation and the Southwest Minnesota Foundation, CBS will investigate the potential of partnering more closely with higher education institutions from MnSCU and the Hormel Institute in southern Minnesota in order to strengthen student education in biotechnology. Industry in that part of the state is poised to develop further, but there is a need for a broader pool of skilled talent from which to draw. The college will examine its articulation agreements with appropriate institutions and consider the potential of student cooperative educational programs and other mechanisms to share expertise.
• Raise the admission standards for the LSSURP program to ensure successful admittance to graduate and professional programs.
• Reduce the size and increase the quality of the LSSURP cohort in order to provide more service on a personal level to students during the summer.

**Measures of Success:**
- Minimum of 5 businesspersons from Omicron-Boule’ involved in 2004 summer UG programs.
- 45% of LSSURP students (juniors) from summer, 2004, apply and get accepted into U of M graduate programs.

(Because the application, review, and admissions processes are still underway in our graduate programs, we do not have complete data on the degree of success of our summer/fall 2003 efforts to increase matriculation of LSSURP students to the U of M. However, 42% (13/31) of the juniors in the 2003 summer program applied here, a big increase from the approximately 3 students who applied to U of M programs the previous year. We will continue to monitor the admission and acceptance rates through the rest of this recruitment cycle.)

3. Faculty and Staff

Improving diversity has been focused on students during the past few years. The recently hired director of human resources for CBS will begin efforts to plan goals and strategies for faculty and staff diversity in consultation with the EEOA office and the CBS Consultative Committee. Plans will take into consideration the current racial and ethnic diversity of CBS programs and the potential for future recruitment.

**Measure of Success:**
- Plan for CBS Diversity established by Fall, 2005.

E. Outreach and Civic Engagement

The college views its outreach activities as a partnership of interactive communication and action, rather than the traditional one-way distribution of information or service. Through its faculty and staff, CBS engages in a wide variety of partnerships with business/industry, K-12 education, professional organizations, government and other communities. The accomplishments of our teaching and research are initially informed by the challenges of society, the natural outcome of which is an understanding, engagement, and application of scholarship to those challenges. We identify the current challenges, problems, and their solutions, but it is the students we train who will impact the future as part of an educated work force. Our primary purpose is not to educate exclusively within the walls of the university but within the realms of society to promote a lifelong discovery and dissemination of knowledge. The multiplier effect is produced through our partnerships with our external partners (business/industry, K-12 education, organizations, government, and communities) where basic research is often translated into new solutions for old problems.

To more clearly understand the college’s role in the University’s civic engagement efforts, the dean has asked the CBS Consultative Committee to gather and assess information from across the college regarding its public engagement activities. A general description of these activities will be circulated within the college to further inspire ways of enhancing civic engagement from the perspective of science education and research. Below are highlights of current college activities related to outreach and engagement.

1. Science Education Partnership with Greater Minnesota

As a result of funding from the Howard Hughes Medical Institute, we are using the Itasca Biological Station and Laboratories as our campus for courses, seminars, and meetings for teachers and students participating in the Science Education Partnership in Greater Minnesota (SEPGM). General accomplishments of SEPGM, a collaborative effort of the College of Biological Sciences and the College of Education and Human Development include:

- 6 CBS undergraduate students completed an internship and a directed research experience during the 2003 fall semester in science classrooms of four school districts in NW Minnesota.
- We recruited four additional school districts to participate in the program for fall, 2004.

Initial response to the program has been very positive. Teachers have actively recruited new teachers from the area to the program and have expressed interest in continued participation. Three of the six students intend to actively pursue teacher licensure, which meets the goal of the HHMI grant: to broaden the base of future science education teachers for rural Minnesota.

**Goals for 2004-05:**
• Recruit 14 interns for 2004 fall semester.
• Evaluate current program with teachers and students and use results to strengthen the internship experience.
• Conduct three Teacher Institutes.
• Involve 6-12 students from the participating school districts in activities at CBS.
• Institute science equipment and materials lending center for use by participating school districts.

2. Common X – Critical X

In partnership with the St. Paul Public School System and supporting partners, CBS has proposed to NSF a 5-year project that would strengthen science education of current high school teachers and U of M faculty. This multi-tiered professional development program aims to:

• Deepen middle and high school teachers’ understanding of science content and process.
• Increase both secondary and college science teachers understanding of science-specific pedagogy.
• Support these teachers in translating these new understandings and skills into their classroom practices.
• Increase teachers’ and professors’ capacity to teach in ways that promote access and equity in heterogeneous classrooms and courses.
• Foster reflection within a community of peers around critical factors in their own teaching practice.

Biology would be used as a framing concept for learning physical sciences. Results of that work will inform the college’s own curricular efforts in that direction. Robin Wright, Associate Dean for the Curriculum and Faculty Development, will serve as Principle Investigator if the grant is awarded. NSF has declined the proposal and the college is working with the St. Paul Public School System to consider when to resubmit.

3. Science Museum of Minnesota

CBS continues to build partnerships with the Science Museum of Minnesota on various projects such as the “Prairie Maze” exhibit being designed with David Tilman’s participation, and a new summer camp for 4th – 6th graders on a bio-investigators research program. Another project with the Science Museum also includes the Freshwater Society, and will focus on the development of a national traveling exhibit entitled “Water is Life”. CBS is considering how to incorporate local student research components as part of the exhibit. The CBS Dean was recently appointed to the Board of Trustees of both the Science Museum and the Freshwater Society, which will further strengthen University ties with these institutions.

4. University Enterprise Laboratories

A non-profit organization entitled University Enterprise Laboratories (UEL) has been created to oversee a laboratory-based incubator facility located in the industrial area between the two campuses. The leadership of CBS and the University Foundation has secured most of the funding, including a major contribution from the U of M. A significant amount of internal University discussion about the challenges for technological transfer of the University’s intellectual property occurred during the development of a new Regent’s policy on technology transfer. The policy helped regents, administrators and faculty leadership understand how the University can help its intellectual property have a greater impact through external commercialization. Start-up companies, many of whom utilize the University’s research results, need an incubator of wet-lab space to conduct further development. UEL is an entity that will meet this need. Construction and renovation work will occur when the fundraising phase of this effort is concluded this spring. The number of requests for such space from biotech start-ups is steadily increasing. Several of the first tenants will be fledgling companies currently leasing space in Snyder and Gortner Laboratories who are ready to move to a larger space with adjoining wet labs. The University’s new Office of Business Development will also reside in the facility. UEL is projected to be at 100% capacity by Fall, 2005.

5. Economic Development

The College of Biological Sciences continues to develop relationships with major Twin Cities corporations, regional small and growing biotechnology companies, and early-stage startup companies. The College is also actively involved in working organizations such as MNBio, Minnesota Technology Inc., Minnesota High Technology Association, the Department of Trade and Economic Development, the Department of Commerce and the Cities of St. Paul and Minneapolis. During the past year, the college was heavily involved in Governor Pawlenty’s BioScience Council, helping to develop a state-wide strategy to strengthen Minnesota’s bioscience industry.

6. Other Faculty Activities
Investigative Plant Biology for Elementary Teachers is a program entering its 13th year. Co-led by CBS faculty and experienced elementary school teachers, this program provides a 2-week summer workshop held on the St. Paul campus and the Landscape Arboretum followed by 3 meetings during the school year for 2 semester graduate credits. A retrospective 1 year analysis shows that teachers who have attended the program have made significant changes in the way they teach science in their classrooms.

CBS faculty, with faculty from the Medical School, have taught a short course on molecular biology for Medtronic for the past six years. At the request of Medtronic, faculty are developing a longer course for Advanced Molecular Biology, which will also include stem cell biology and the molecular and cellular biology of selected chronic diseases.

Faculty also serve on national review panels, task forces, editorial boards; meet with outside economic groups or companies; speak at alumni and community gatherings; and serve as guest lecturers or members of senior defense committees at regional four-year colleges. All CBS departments, in their annual review of faculty, include this component as one of the performance measurements, which, in turn, contributes to faculty’s compensation adjustment.

F. Enrollment Management

CBS views enrollment management as a guide to shaping the quality and characteristics of the CBS student body. Our desired outcomes are to admit, enroll, and graduate students with increasingly higher academic abilities and who reflect the diversity of the population from which we draw our student applicants. CBS’s top priorities in this area include completing a detailed analysis of our student and Bachelor’s degree graduate demographics and outcomes, and developing a comprehensive enrollment strategy that assesses our efforts in recruitment and retention and an analysis of CBS’ optimal undergraduate enrollment capacity. By 2009, we will increase our 4-year graduation rate to 50% and for those students who fail to graduate in 4 years, CBS will identify and analyze the causes. In addition, we will develop programs to recruit, retain and mentor students from underrepresented groups.

Recruitment & Admissions CBS is committed to retaining its NHS student matriculations at the current level of 350. Although we have the capacity to grow, a decision to maintain 350 was made in consultation with Wayne Sigler, with the goal of increasing the quality of students and increasing retention. In consultation with Wayne Sigler, we made goals of increasing retention and quality of entering students.

This decision has been approved by the Provost. It is a CBS priority to increase the diversity among our entering first-year class. In Fall 2003, 17.1% of our undergraduates were students of color. Working in cooperation with Admissions, CBS will evaluate its current efforts and develop a comprehensive plan for increasing diversity. Further information is detailed in the Diversity Assessment and Planning section.

Retention We continue to be pleased with our freshman retention rate of 85%. CBS is proud of its programmatic emphasis on the first-year experience through the development of its signature Nature of Life program and follow-up activities, required advising appointments, and updated orientation program. However, in a recent examination of the profiles of our entering NHS class and our graduating students, we have found that many of our entering NHS students ultimately transfer to other colleges within the U of M or to other institutions. In addition, of the students who began our lower division honors program in the Fall of 2001, 23% of those students had left CBS by Fall 2003. We are deeply concerned by the loss of this number of our brightest students. This issue will be studied further to gain a better understanding of the profile of the students who leave CBS and the composition of our graduates. Based on this analysis, appropriate targeted interventions for each student population will be developed and implemented. An analysis and report on this transfer issue will be submitted to the Senior Vice President for Academic Affairs and Provost by May, 2005.

We are also examining several ways to expand our targeted efforts to increase the retention rates among our minority students. Currently, the CBS Achieving Excellence in the Sciences Program (ACES) boasts a five-year graduation rate of 80% for students of color. The Senior Vice President for Academic Affairs and Provost commits $10,000 nonrecurring to help expand the number of students served from 18 to 35. CBS has allocated staff resources and time to delve further into understanding CBS enrollment and persistence, and develop a comprehensive strategy with our faculty, staff and students to address retention issues. Our goal is to raise our 4-year graduation rate to 50% in 5 years. The college’s 4-year graduation rate will increase by the figures projected below.

<table>
<thead>
<tr>
<th>Year of Entry (First-Time / Full-Time Entering Freshmen)</th>
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90+ Credit Mark: As per our agreement with Vice Provost Craig Swan, CBS and the Senior Vice President will continue to partner in 2004-05 and 2005-06 academic years to develop an individual written graduation plan for each CBS student with 90+ credits. The Senior Vice President for Academic Affairs and Provost will provide $3,750 per year in additional one-time resources and CBS will contribute $1,250 per year to fund the initiative. CBS will use these funds to hire temporary staff to update the APAS system so that students may be better served by these reports. Currently, each CBS undergraduate major has many intricacies and exceptions to the requirements that are not captured in the APAS system. In addition, Academic Advisors will make personal contact with each student with 90+ credits to schedule an advising session and to develop a graduation plan. Since Fall of 2003, all incoming NHS students are required to develop a 4-year graduation plan to receive credit for the Nature of Life program.

Measures of Success:

- The CBS four-year graduation rate will increase to greater than 50% in 5 years.
- Analysis of retention and graduation data for all student demographics will be completed by January 2005.
- The Achieving College Excellence in Sciences (ACES) program will be expanded from 18 students to 35 students by Fall 2005.
- CBS will make personal contact with all students with 90+ credits, and have a graduation plan on file by December 2005.

Fiscal Year 2004-05

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<td>90+ credit project (as per previous agreement)</td>
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<tr>
<td>Expansion of the ACES program</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$13,750</strong></td>
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</table>

Central contribution: $13,750

RRC Contribution: $1,250

Admissions: CBS has submitted materials and is working with the Office of the General Counsel to ensure that the college’s admission program meets constitutional standards as set forth by the U.S. Supreme Court.

G. Facilities Issues

1. Compact Initiative Impacts and Space Management

The attached grid in Appendix B illustrates how critical facilities issues for CBS affect undergraduate and graduate education; research; and outreach. Each facility affects most components of the CBS mission, and each is part of the major capital investment priorities described below.

In addition to those priorities, CBS needs to create facilities on the Minneapolis campus for advising students, as described in the section on Undergraduate Students above. The CBS advising office is housed on the St. Paul campus, even though most of our students attend classes and live on the Minneapolis campus. We have identified suitable space but it will require renovation to create private office space and equipment to serve students. Because the space is near the Health Careers Center, these changes will enable us to continue to develop strong synergies with the Academic Health Center to provide health sciences career advising. The cost of this renovation is approximately $200,000.

2. Major Capital Investment Priorities (listed in priority order)

   a. Cedar Creek Natural History Area (CCNHA)

   Description: Construction of a Science, Outreach and Education Building with separate public and community outreach and laboratory wings; construction of new researcher/student housing consisting of four small cabins and a tent-based, permanent, campground-like facility.

   Justification: CCNHA is among the world’s foremost ecological research sites, dedicated to understanding our planet’s ecology through research and education. The historical designation as a “natural history area” is now a misnomer—it is more appropriately considered as the University’s largest
research laboratory, with 4,500 acres. During the past decade, vast increases in research and training at Cedar Creek have greatly overtaxed its facilities. In the past 20 years, the number of people employed on various field research projects at Cedar Creek has increased from about 12 people to over 100 while there have been no new research facilities constructed and, since 1988, no housing updates. To accommodate the continued expansion and enhancement of CCNHA activities, two major facilities are proposed: A new Science, Outreach and Education Building that will have two wings, one with multifunctional auditorium, conference rooms, classrooms, offices and kitchen facilities and the other with wet and dry labs, computer room, meeting rooms, sample storage rooms, and offices. Additional new on-site housing will consist of four, small, 3-bedroom cabins for researchers and a separate, campground-like permanent facility that will include platform tents (like the rental “tents” offered in many National Parks). The tents would be used by students to save on travel to and from campus. A shared Commons containing bathrooms, a common cooking area, an eating space, a large living area, a safe shelter in case of severe storms, and a large deck would also be included.

**Projected costs and funding sources**: $4.1 million to be obtained from combination of private donors, LCMR and NSF. An update on funds raised to date and the status of LCMR and NSF requests will be sent to the Executive Associate VP for Planning and Academic Affairs by mid-February, 05.

**b. Lake Itasca Biological Station and Laboratories**

**Description**: a) Construction of a new multipurpose education and student resource center; b) Construction of a new, single laboratory building to replace a number of old, outdated labs; 3) Renovation/modernization of existing lakeside lab building.

**Justification**: The Itasca Laboratories, located in Itasca State Park, is nationally recognized and has been in continuous operation since the University founded it in 1909. The Itasca station serves more than 1,100 students, researchers, faculty, and visitors each year. Over the past 10 years the station has averaged approximately 10,000 bed nights per year. It is truly a University-wide facility, hosting educational and research programs and various faculty and student groups from eight colleges. It also serves Minnesota by hosting groups such as the Department of Natural Resources, 4-H, and Bemidji State University. The station sits at the headwaters of the Mississippi River, as well as the confluence of three great plant biomes, offering not only a unique and perfect location for field studies but also a retreat-like setting for intensive courses in neuroscience and molecular biology. Both the quantity and quality of space currently limit the educational, research, and outreach programs. The three components of the planned expansion and renovations will meet separate, yet complementary needs: a) A new multipurpose building will enable the station to accommodate the increasing numbers of students, faculty, and citizens who take advantage of the station programs and facilities, e.g. through the Science Education Partnership in Northern Minnesota, the Nature of Life program (see above) and laboratory-based “boot camps” for students in four graduate programs in biosciences. It will also encourage greater use of the station for workshops and small conferences, benefiting a variety of University and non-University constituencies. The building replaces an outdated structure that is not ADA compliant and will also enable the station to better serve the approximately 500,000 people who visit the park on an annual basis. b) The proposed single laboratory building will replace a number of old, outdated labs that suffer from serious structural problems such as cracked and shifting foundations, inadequate heating or ventilation, as well as basic ADA deficiencies. The new up-to-date facility would encourage additional faculty to offer courses and carry out research at the station. c) The Station is extremely interested in formalizing a “train the trainers” program that helps K-12 educators in the surrounding region to better understand nature and place to get hands-on experience in different aspects of biology that can be easily transferred into a K-12 classroom. Our major limitation is appropriate laboratory and testing space. With some renovation the Lakeside Lab, a stone and frame building located directly on the shore of Lake Itasca, would be an ideal site for this purpose.

**Projected costs and funding source**: a) Multipurpose building - $3.4 million; legislative request. b) New laboratory building - $2.5 million; legislative request. c) Renovation of lakeside lab building - $230K; reapplication to NSF. d) Construction of a new lakeside lab building - $230K; reapplication to NSF. e) Renovation of existing lakeside lab building - $230K; reapplication to NSF. f) Construction of new lakeside lab building - $230K; reapplication to NSF. g) Renovation of existing lakeside lab building - $230K; reapplication to NSF. h) Construction of new lakeside lab building - $230K; reapplication to NSF. i) Renovation of existing lakeside lab building - $230K; reapplication to NSF. j) Construction of new lakeside lab building - $230K; reapplication to NSF. k) Renovation of existing lakeside lab building - $230K; reapplication to NSF. l) Construction of new lakeside lab building - $230K; reapplication to NSF. m) Renovation of existing lakeside lab building - $230K; reapplication to NSF. n) Construction of new lakeside lab building - $230K; reapplication to NSF. o) Renovation of existing lakeside lab building - $230K; reapplication to NSF. p) Construction of new lakeside lab building - $230K; reapplication to NSF.

**c. Renewable Energy and Materials Laboratory**

**Description**: Design and construct a new, three-story building in the Biotechnology Quadrant of the St. Paul Campus to house the Renewable Energy and Materials Laboratory (referred to as the Biocatalysis, Biomaterials and Biosensors Research Laboratory in the 2003-04 compact). This would be

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closely associated both physically and programmatically with the Cargill Building for Microbial and Plant Genomics.

**Justification:** This is the second phase of construction on the part of the St. Paul campus designated by the University Master Planners as the Biotechnology Quadrant and is an important component of our anticipated future expansion of biotechnology education and research programs. The laboratory, in association with the other units housed in the Biotechnology Quadrant, will support interdisciplinary interactions among faculty working separately on bio-biocatalytic processes, biomaterials and biosensors, research areas that are interdependent and will become even more so in the future. In addition to futuristic, bio-based materials that can be produced using biocatalysis or developed into biosensors, many of the scientific methods utilized and developed in these research areas can be applied to create energy from renewable sources. For example, hydrogen, the ultimate fuel, can be produced using engineered microbes. This facility will capitalize on the newly funded Initiative in Renewable Energy and the Environment (IREE) and will serve as the administrative focus for the initiative. It will also provide space to bring together current faculty and newly recruited faculty from several colleges. Specialized facilities will enable the research in these interdisciplinary areas to move at a competitive pace. For example, a major component of the building will be an expanded pilot plant facility under the BioTechnology Institute that would serve University faculty in several departments as well as an expanding external user base. The current pilot plant is already limited in space and capacity and we expect the demands on this facility to increase substantially over the next several years.

The Renewable Energy and Materials lab will also serve both undergraduate and graduate educational programs in these rapidly developing fields. Student interest in biotechnology is increasing and contributing to the rapid increase in UG biology and related majors. It is critical that our physical facilities be able to accommodate the increased student demand, while providing state-of-the-art programmatic support.

**Projected Costs and Funding Sources:** $35 million; combination of federal earmarking and private gifts.

d. Biological Sciences Center - Behavioral Biology Laboratories and Vertebrate Animal Quarters

**Description:** Renovation of a portion of the basement of the Biological Sciences Center to allow for animal housing and laboratory space.

**Justification:** Recent faculty searches in the department of Ecology, Evolution and Behavior have failed due to a lack of adequate behavioral biology laboratories and, particularly, of contiguous vertebrate animal quarters. As one of the University’s premier departments, these failures to hire are a serious threat to the reputation of the department, the college, and the University. Behavioral studies require that animals be observed for extended periods in the laboratories and be moved frequently in and out of the observation areas; thus, having adjacent animal housing is essential. This is a very specialized need that cannot be accommodated within current RAR facilities. Renovating a portion of the basement of the Biological Sciences Center for these associated facilities will allow for the retention and recruitment of faculty in the college’s premier department and will potentially be used by faculty conducting behavioral research from other collegiate units. Initial discussions and a walkthrough with Dr. Gillett, Director of RAR, occurred in December, 2002, to determine the feasibility and consistency with general RAR policies and directions. Security issues were included in discussions with Dr. Gillett and ways to approach these issues are included in the cost.

**Projected costs and funding source:** $1 million, potentially from legislative funds.

e. Undergraduate Teaching Lab

The Task Force on the CBS Curriculum has made recommendations for a revised structure of the curriculum for CBS majors, and includes a recommendation about facilities that we support. The Task Force recommends a two-semester lab and experiential learning course for all students majoring in the college. Facilities for such a course are currently unavailable and will require substantial renovation of existing facilities. Very preliminary estimates suggest that such a renovation and purchase of equipment will be approximately $6,000,000.

**Projected Cost and funding source:** $6 million, potentially from a combination of internal and state funds. The college will research potential funds from federal sources as well.

H. Financial Issues

Please see graduate support section, above.
Tuition: The agreed upon tuition revenue estimate for the College of Biological Sciences is $10,309,510 for fiscal year 2004-05.

ICR: The agreed upon ICR revenue estimate for the College of Biological Sciences is $1,779,322 (49.5% of $3,594,590) for fiscal year 2004-05.

I. Compact Development

Throughout the compact planning process, the College has attempted to keep the faculty informed and has solicited their input through the use of the following mechanisms: monthly meetings with department heads/directors; compact planning meetings with departments; several all college meetings, with at least one on each campus; and the college’s monthly newsletter. In addition, the Dean has welcomed input via email and in one-on-one meetings with faculty members.

J. Data Profile

For a display of planning data related to the College of Biological Sciences, refer to a link off the University web site managed by the Office of Institutional Research and Reporting at http://www.irr.umn.edu. This site contains standard financial, staffing and student information.

K. Report Summary and Allocation Summary


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Central Allocation Summary – FY2004-05

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* As of September, 2004
Attachment 1

Sampling of Projects Recently Funded by IREE
www.iree.umn.edu
CBS 2004-05 Compact

- Develop a working biomass and carbon sequestration demonstration project called Prairie Maze at the Science Museum of MN about renewable biomass energy, ecosystem biodiversity and other ecosystem services of value to society.

- Design wind turbines at U of M Morris to incorporate wind-to-hydrogen research, including hydrogen storage, transportation and use. Biofuel generator can be used to test potential new biofuels and additives.

- Develop research infrastructure at Southern Research Outreach Center to assess productivity potential of native cottonwood and poplar hybrids in Southern MN.

- Make biodiesel from crop residues by testing biodiesel made from renewable biomass other than vegetable oil.

- Use genomics tools to manipulate carbon partitioning to increase crop yields of biofuels and biobased products, with identification of genes that help control seed oil and protein production by oilseed plants such as soybean.

- Evaluate opportunities for the production of bioenergy and biomaterial products from alfalfa and willows, building on existing research.

- Design a renewable roof for residential buildings by replacing conventional wood trussed roofs with an insulated roof made of fiber reinforced polymer materials. Incorporate solar technology into a composite roof structure so that it becomes part of conventional construction rather than expensive add-on.

- Implement solar thermal energy into the residential and commercial market by making solar water and space heating systems more cost competitive with conventional electric and natural gas systems.

- Clean Energy Resources Teams (CERTs) will engage communities in determining their energy future by giving citizens a voice in energy planning. Identify “best bet” pilot projects in their region. Promote energy independence for communities throughout MN.

- Define a set of rules to apply in the conduct of full cost accounting of energy technologies and begin to apply rules to account for the complete life-cycle direct and external cost associated with renewable energy methodologies proposed by other clusters within IREE.
## CBS Programs and Priority Facilities

### Warp and Weave

**Academic Program**

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<thead>
<tr>
<th>Facility</th>
<th>Undergrad Education</th>
<th>Graduate Education</th>
<th>Basic Research</th>
<th>Outreach</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Cedar Creek</td>
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<td>IREE</td>
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<td>Itasca Biological Station</td>
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<td>Nature of Life; Grad Boot Camps; SEPGM</td>
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<tr>
<td>Renewable Energy and Materials Lab</td>
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<td>Undergraduate Teaching Lab</td>
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<td>Core Labs; Project Labs</td>
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</table>

**Impact Levels**

- **High Impact**
- **Medium Impact**
- **Lower Impact**