Academic Plan for 2009-2014

College of Biological Sciences

University of California, Davis

Sustaining Excellence in the Biological Sciences

Submitted by Kenneth C. Burtis, Dean
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Cover photo: When the work of a faculty member in the College of Biological Sciences “makes the cover” of a peer-reviewed journal, the cover is framed and hung on the walls of either Briggs Hall or the Life Sciences building. One of many such walls is shown.
I. COLLEGE OF BIOLOGICAL SCIENCES ACADEMIC PLAN FOR 2009-2014

A. OVERVIEW AND EXECUTIVE SUMMARY

1. Preface

The last ten years have been a remarkable decade in the history of the College of Biological Sciences. At great expense in faculty time and effort, and college and campus resources, the College has achieved record levels of excellence in the quality of its faculty research programs, the breadth and sophistication of its research infrastructure, and the innovative nature of its curriculum and instructional space. Over the past decade, total non-state funding and total federal grant expenditures administered through the College roughly tripled (Appendix I) during a time when the faculty headcount increased by less than 50% (including non-CBS faculty in the Genome Center and Center for Neuroscience) and the overall funding rate for R01 grants dropped by more than 25%. During this same time period, three CBS faculty members were elected to the National Academy of Sciences, and many others received honors and awards (Appendix IIIB). In fulfilling its teaching mission, the College developed a cutting-edge introductory biology curriculum taught in one of the most advanced undergraduate sciences laboratory classroom buildings in California. This remarkable progress has been achieved through traditional academic efforts in the departments of the College, as well as through the interdisciplinary and research-focused efforts of three extant centers; the Genome Center, the Center for Neuroscience, and the Center for Population Biology; as well as one Center (the Center for Genetics and Development; 1999-2006) that played a key role in hiring several outstanding faculty in the area of molecular genetics. Together, these efforts have brought national and international acclaim to the basic biological sciences at UC Davis, and created an outstanding environment for undergraduate and graduate education in biology.

The College and University are now entering an era during which it will be critical to develop new strategies to sustain and strengthen the excellence that has been achieved at such great expense over the past decade. The limited increases in the student population and financial pressures facing the campus predict an environment very different than that of the past decade, but we must find ways to protect our previous investments in excellence, and prepare ourselves for a future ever more dependent on progress in understanding all aspects of life. Health care, thriving ecosystems, productivity in agriculture, and a well educated populace prepared to deal with the impact of modern biology—all are dependent on research and education in the basic biological sciences. UC Davis has a well deserved reputation in this area, which is reflected in the ever-increasing popularity of the campus among the best and brightest of California’s students, and in the diversity of the graduating senior class. In the biological and biomedical sciences, UC Davis now ranks #6 among US universities in the number of bachelor’s degrees conferred upon Hispanic students, and #1 for Asian American students. In a century when society will depend heavily on progress in biological research, these students must continue to have access to innovative classes and valuable research opportunities with world-class faculty. Sustaining the excellence we have built will not be easy, but it is essential. In a century when society will depend heavily on progress in biological research, these students must continue to have access to innovative classes and valuable research opportunities with world-class faculty. Sustaining the excellence we have built will not be easy, but it is essential.

This document presents our plan to sustain the qualities that define this College: breadth across the disciplines that are critical to modern biology with clusters of strength where possible to optimize investments and create critical mass in certain key disciplines; dedication to an innovative curriculum informed by the latest research in pedagogical methods and the needs of our students; and a strong focus
on opportunities to leverage strengths across campus through participation in cross-college initiatives such as the Center for Population Biology, the Center for Neuroscience and the Genome Center.

2. Objective of an academic plan

The objective of an academic plan is to outline a set of shared goals that we will strive to achieve over the next five years. We will use this academic plan to guide our decisions of how to apportion resources, where to prioritize our efforts, and how to measure our accomplishments. These continue to be exciting and challenging times in the life sciences. We embrace our position among the leaders on this campus in research and teaching, and outline goals that will allow us to maximize our contributions to the campus and community.

The life sciences are undergoing revolutionary changes due to the congruence of several events: (1) the sequencing of genomes of multiple organisms has positioned us to explore patterns, organizations and interdependence of molecules, cells, organisms and their environments in ways that we never could previously; (2) our appreciation that the success of our research and teaching must include cross-disciplinary collaborations among faculty who may not have worked with each other in the past; (3) the need for sophisticated and expensive equipment for our research and our teaching that must be shared and that requires costly support staff; and (4) our realization that an integral part of our work must be to reach out to the wider community to communicate the impact of our missions on the citizens of California and the world.

During the past five years, CBS has continued to build strengths in multiple levels of the biological sciences. We have partnered with other academic units in research and teaching and participated extensively in the successful integration of centers and departments. In this academic plan, we outline an ambitious program to grow even more prominent and respected on campus, nationally and internationally, to lead and participate in critical inter-college campus initiatives, and to participate fully in implementing the campus strategic plan. A theme that runs throughout this document is our goal of increasing the diversity of our faculty, staff and students to reflect the richness and complexity of the community around us that we serve through our research, teaching and outreach. Below, we outline our goals and also metrics by which we will judge our success in the areas of research, teaching, and outreach. To summarize what is included in the following sections:

Research: In this overview and in the far more detailed departmental academic plans, we outline specific areas of biology in which we will focus our recruitments and our resources. Emphasis will be placed on sustaining our strengths in critical research areas and building strength in emerging disciplines through judicious replacement of retiring faculty. When possible, we will leverage our resources through strategic partnerships between departments and other campus units.

Teaching: We will continue to develop and implement new undergraduate curricula that emphasize the importance of quantitative skills, problem solving, critical thinking and clear writing, and will continue to encourage pedagogical innovations by our faculty. We remain intent on enriching the learning environment for highly motivated undergraduates in the College through the development of an honors program that recognizes the critical importance of research experiences in our research laboratories. A major development goal will be to increase the number of fellowships available to support graduate education.
Outreach: We will redouble our efforts to communicate with the wider community, our students, faculty and the campus administration, so that our mission in the basic biological sciences is understood, and its impact on the lives of all is clear to everyone. We will continue to develop relationships with alumni, parents, friends and the corporate community with the hope that they will understand and recognize the opportunities to enrich our ability to serve them better.

3. Past accomplishments

This academic plan focuses on the future. However, our goals and aspirations rest upon our past successes. I outline briefly below some of the most important accomplishments of the last five years.

- **Completion of the change from a Division to a College.** After many years as a joint Division of the College of Letters and Sciences (L&S) and College of Agricultural and Environmental Sciences (CA&ES), we completed the process of becoming a college in 2005. Major impacts of this change have included the creation of a College Executive Committee, leading to increased levels of consultation and shared governance between the faculty and administration of the College; development of an increased sense of identity among the students of the College; and facilitation of development efforts aimed at increasing loyalty and support among alumni of the College.

- **Achieved record levels of research funding.** As illustrated in Appendix IA-IC, research funding (as reflected in non-state expenditures and total federal grant expenditures) has risen consistently over the years, despite a very competitive federal funding environment and very limited growth in state funding supporting the infrastructure. Research support in CBS is predominantly from federal agencies (NSF, NIH); however, significant funding comes from private foundations. Total non-state expenditures grew to over $52 million in 2007-2008, with direct federal grant expenditures alone rising to almost $31 million (see Appendix I). It is of interest to note in Appendix IA that the rise in expenditures was relatively constant over this ten year period, despite the fact that the last five years saw very little increase in expenditure of state funds (an increase of 26% in non-state expenditures from 2003-2008, during a time when state support increased by less than 3%).

- **Completion of a major undergraduate curriculum revision.** For the first time in many years, we undertook and completed a coordinated and comprehensive revision of our core curriculum, recognizing the incredible changes that have occurred in the life sciences. Our revisions have provided our undergraduates with a curriculum that breaks away from the isolated consideration of various kingdoms of life and scientific disciplines, and focuses on the integrative and interrelated concepts that define our post-genomic view of life. New courses also recognize the importance of quantitative skills in modern biology.

- **Completed the initial phase of development of the Genome Center.** Hiring of the initial cohort of Genome Center faculty is almost complete, and has led to the creation of a highly interdisciplinary research center with internationally renowned genomics faculty whose mission is to provide enabling genomics technologies to research groups across campus. Co-housing of faculty from several colleges in the Garamendi-funded Genome and Biomedical Sciences Facility has enabled new cross-disciplinary collaborations that are critical to modern biology.

- **Recruited 37 new faculty between 2003-2008.** A series of successful recruitments, most often concluded by hiring of the highest ranked candidate, have brought our faculty headcount to 130. Over the same period 21 faculty retired, leading to 14% growth. Recent hires have included
11 female faculty and 6 underrepresented minority faculty members (3 Asian, 1 African American and 2 Hispanic/Mexican-American), significantly increasing the diversity of the College.

Our undergraduate students continue to be outstanding, and have been frequently recognized for their impressive accomplishments. One metric of their success is the number of commencement ceremony awards given to CBS students (see Appendix IIA). CBS faculty members also continue to receive many prestigious awards and honors (see Appendix IIB). Additionally, although it is hard to track with accuracy, the publication record for CBS faculty shows steady growth over the last five years, with many publications in high-profile scientific journals. Our records show that the faculty have published between 150-250 articles annually, with articles frequently appearing in *Science, Nature*, the *Proceedings of the National Academy of Sciences*, and *Cell*, journals that have the highest impact factors and are considered the most respected broad-audience journals in the biological sciences.

4. **Response to the “Call for Academic Plans”**.

The *Call for Academic Plans* presented a list of topics that submitted plans were expected to consider. Most of these topics are explored in greater detail in the following text, but the major issues and College of Biological Sciences responses are as follows:

- **highest priorities, programmatic strengths, and targets for development.**
  The highest priority of the College is to retain its hard earned excellence in the biological sciences. In the absence of significant growth, no single disciplinary area stands out as the single highest priority; extant areas of strength in neuroscience, evolutionary genetics, cell biology, biochemistry and plant biology remain critical; as do emerging or rebuilding areas of strength in structural biology, genomics, microbial physiology, community ecology and animal physiology. Targets for development that transcend departmental (and college) boundaries include comparative genomics and integrative/systems biology, but these two areas do not comprise the only strategic priorities for the College.

- **opportunities to strengthen programs via collaboration with other units/campuses.**
  The College collaborates extensively with other campus units through its participation in the Genome Center (COE/MPS/SOM/CA&ES), the Center for Neuroscience (SOM/DSS), the Center for Population Biology (CA&ES) and the Bodega Marine Lab (CA&ES/MPS/SOVM). These collaborations involve joint faculty hires as well as shared instrumentation and core resources. Maintaining the strength of these units is dependent on collaboration between the participating colleges, and requires the cooperative support of the departmental faculty and administration in recruitment and academic support.

- **faculty – current size and some discussion of optimal size; projected retirements in next 5-7 years; priorities in terms of new faculty hires; assumptions for start-up packages for hires during planning period; availability of suitable space; diversity goals and opportunities.**
  The current head count in the College of Biological Sciences is 130 faculty, including several with partial and joint appointments. The optimal size is a function of student headcount in the college majors, market-driven teaching loads, maintenance of research excellence and critical mass in areas where large investments in research infrastructure have been made, and the budgetary constraints operating on the College and campus. With respect to departmental planning, of the five departments in the College, the two smallest departments wish to grow by 4-
The rate of retirements in the College can be predicted to be about 5.6 retirements/year based on the number of faculty (28) who will reach age 65 by 2014. The six faculty who have preliminarily indicated that they might retire next year range in age from 59 to 74, with an average age of 64, supporting this estimate.

Initial priority for new faculty hires is targeted to areas (biochemistry and exercise biology) where explosive growth in student numbers is straining the ability to deliver the curriculum. Given the overlapping disciplinary areas and teaching expertise in the departments of the College, this does not require hiring in a specific unit; prioritization will also depend on leveraging available resources, maximizing the probable success of acquiring extramural funding, and in one case (Exercise Biology) fulfilling FTE commitments made by the College and campus at the time the unit was transferred to Biological Sciences from Social Sciences. Another top priority is maintaining the strength of our outstanding Department of Evolution and Ecology, which has faced challenges in terms of its local critical mass due to the placement of five faculty in geographically remote locations (the Genome Center and Bodega Marine Lab). The very large investment in research infrastructure in the cryoelectron microscopy facility dictates that another very high priority should be the hiring of an additional faculty member (in CBS or COE) who can utilize the microscopes and assist in funding the ongoing costs of maintaining the facility.

In the College of Biological Sciences, the average competitive startup package for new faculty comparable to those recently hired is approximately $750,000, including first year off-scales, summer salary if needed for two years, recruitment/removal, housing allowance, laboratory renovations when needed and the startup package (this is assuming a wet lab hire; computational and theoretical hires may be $200K-400K less). Given the predicted rate of retirements, this predicts an ongoing cost of over $4M per year just to maintain the status quo, assuming that costs remain steady and most of the hires are for wet lab positions.

New space is not a large issue at present, assuming that most hires will be replacements of retiring faculty and given that most of the space in the buildings of the College requires only modest upgrades. There are large infrastructural improvements in Briggs Hall that remain to be finished (seismic and safety related projects); if this building were to become unusable, there would be serious space issues. The other major pending space issue for the five year planning period involves the Center for Neuroscience. Long term plans for a $105M building to co-house all neuroscience faculty on campus were aborted three years ago in the face of a looming state and campus budget problem. Although disappointing to the faculty, alternative plans were developed to enhance the existing buildings to meet urgent Center space needs at a cost of $10M; this effort continues to the present.
The College is and remains strongly committed to continuing to increase the diversity of our faculty to reflect society at large. In the past year, we have successfully recruited three faculty from underrepresented minority groups; one Mexican-American, one Spanish-American, and one African-American. Progress was also made towards achieving gender diversity and increasing the representation of Asian-American faculty.

- **curriculum – describe anticipated changes, discuss current challenges (for example, an issue with a core requirement or course delaying graduation or limiting enrollment in the major, inability to utilize computer classrooms, impacted major, etc.).**

The College just completed a major overhaul of the introductory core series and is now working to perfect and stabilize the new curriculum. The most significant change being considered by the CBS Faculty Executive Committee over the next year is the possibility of creating a dual track system for entering freshman students, in which all entering freshman would be assigned to the Biological Sciences major, with transfer into other majors (e.g. genetics, plant biology, microbiology, exercise biology, etc.) only possible after completing defined introductory courses and meeting specific performance criteria. An underlying rationale for proposing this change is budgetary; the courses (particularly upper division labs) in the various majors are unsustainably expensive to offer and may not be optimally designed for students having difficulty in the prerequisite courses or intent on following career paths not involving the laboratory sciences. Consideration of this option is in the very preliminary stages, but will be discussed at length in the Faculty Executive Committee meetings this year. Other related issues include the possible declaration of an impacted major in Exercise Biology, where explosive growth in the number of majors and the high cost of labs has created an imbalance in faculty-student ratios in the program and an unsustainable budget shortfall. Although many Exercise Biology majors are pursuing career plans in allied health fields such as physical therapy where there are predicted shortages in coming years, and therefore represent an important resource to the state, we must nonetheless determine a sustainable size for this major in the absence of alternative revenue sources.

- **graduate student goals, opportunities, and constraints for departmental based programs**

In almost every case, the chairs of the graduate groups housed in the college expressed the opinion that the optimal size of their entering class would be about 50% greater than the current class size, based on the number of faculty in the group, the number and quality of applicants, and the availability of financial support for continuing students. In each case, the limiting factor was money, whether for recruitment expenses, first year support during lab rotations, or the need to supplement continuing students on training grants with non-federal funds. Other common themes include the very negative impact of non-resident tuition costs on the ability to enroll absolutely stellar foreign students, and the critical need for more extramural training grants to reduce the burden of graduate student support on limited extramural research grant funding. Many groups are trying to increase the number of training grants, with some limited success, and it is likely that if increased funding becomes available that the number of entering students will rapidly increase. Group chairs also face perennial issues in addressing curricular needs, due to the lack of linkage between departmental faculty and teaching assistant assignments and grad group priorities. Another problem hindering their ability to fill their teaching needs is the reluctance on the part of some departments to allocate full credit for graduate teaching (this is not the case in CBS). Finally, two chairs mentioned their disappointment at the 10% reduction in the already modest
administrative stipend for service as a chair. It would be helpful if this cut could be restored when budgetary circumstances allow.

- **assessment mechanisms to measure success.**
  Metrics for success are described in the text below.

- **resources – describe most significant resource challenges and opportunities in relationship to achieving the goals articulated by the plan, keeping in mind that the state continues to face significant budget challenges.**
  By far the most significant resource challenge facing the College is the cost of competitive startup packages for new faculty. As the College has developed a national and international reputation for excellence, it has begun competing with the leading universities in the country to recruit the top candidates. The competition to hire is market-driven, in that these candidates, many having multiple job offers, compare offers from different universities with respect to startup funding, salary, quality of space, teaching load and collegial and institutional reputation. Since many of these are variables, there is often a bidding process to attract the first choice candidates. Given the availability of resources at some of the competing institutions (including public universities in other states), the average cost of startup packages has risen much more rapidly than inflation or available resources at UC Davis. To date, the College has had little choice but to continue to compete in this market, placing enormous pressure on resources. It is perceived that the top choices are more likely to be successful in obtaining extramural funding, in publishing in top ranked journals, and in being the recipient of national honors and awards. The reputation of the College is tied to these metrics, and substantial resources have been invested in hiring a cohort of outstanding young faculty over the last decade. Continuing to hire in this competitive market is essential for sustaining excellence, and for retaining the stellar faculty already hired in the face of competing mid-career offers.

  What opportunities might be considered for dealing with this intractable problem? It is unlikely that the cost of startups will decline in the near future; indeed, recent history would predict just the opposite. Thus, it is necessary that new revenue streams be identified to assist the university in remaining competitive. Ideally, the state would recognize the important economic benefits of preparing a scientific workforce and thus provide new resources. However, while the state leadership clearly understands the economic benefits, state resources are very constrained in the immediate future. In the absence of additional state support, and with the limited ability of the university to direct additional resources to this purpose, the only alternative source of revenues must be from philanthropic or extramural sources. In the case of philanthropy, it seems unlikely that sufficient endowments could be generated in the time frame of this plan to generate interest income sufficient to make a real difference in addressing this problem (almost $19M would be required to generate one startup package per year; a $105M endowment to cover the annual cost of replacing retiring faculty from CBS). An alternative is to seek current use funds to defray the cost of startups rather than endowments. The creation of a suitable naming opportunity (e.g. Named Fellows) that would last for the lifetime of the new professor would be an attractive option for some donors while more immediately addressing the current problem. Another possibility would be revenue generated from salary recovery on grants where possible. This will require the creation of an incentive for faculty participation that does not currently exist; perhaps in the form of a salary incentive such as exists for many health sciences compensation plans. Imposition of such a practice without incentives would be counter-productive, in that one of the standard benefits of being a biology professor at a public university rather than in a medical
school (where salaries are often higher) is the lack of a requirement to put salary on grants. Loss of this benefit, unless all competing institutions implemented similar policies, would render us uncompetitive in hiring the best biology faculty. There is an urgent need to begin addressing one or more of these possible opportunities, if UC Davis is to retain its well-earned reputation in the life sciences for the coming decades.

One aspect of startup costs in which the university could benefit by strategic planning is the large investments in equipment needed for certain fields of science. By creating incentives for collaborative planning between different colleges in the purchase of large equipment, it is possible to spread costs through shared facilities that can be used by new faculty. A recent example is the development of an increased degree of organization in the campus mass spectrometry infrastructure through the combined efforts of faculty members and the Office of the Vice Chancellor for Research. New policies on the contribution of matching funds from the Office of the Vice Chancellor for Research encouraged the use by many labs of the common mass spec facilities set up in the Genome Center and at campus satellite facilities, reducing unnecessary duplication of equipment and an associated reduction in maintenance and operation costs. More recently, similar efforts to make joint use of cryoelectron microscopy facilities by faculty from COE, CBS and the SOM have made it possible to spread these costs. The campus and colleges should be vigilant in looking for further opportunities to share the cost and use of large equipment.

Other budgetary challenges are in the area of teaching. One significant fiscal burden for the College is the imbalance between resources available for temporary teaching needs and the instructional needs of the College. Due to a recent rebalancing of central campus contributions towards temporary teaching in an effort to create equity among the different colleges, CBS has had significant reductions in this budget area. Due to the impact of inflating startup costs discussed above, discretionary funds available for restoring these central campus cuts are extremely limited. This has resulted in decreased support for temporary lecturers and teaching assistants, putting pressure on the teaching program, and leading to consequences such as offering courses only in alternate years, reducing the TA support for lab courses, and changing practices such as writing-intensive assignments and examination formats to reduce the workload involved in grading. An obvious alternative is to increase faculty teaching loads; however, as mentioned above, teaching load is one of the market-driven factors determining whether the best faculty join or remain in the College, and we are currently at the average teaching load for comparison institutions. If the resources necessary to fund startup packages were made available to the College, then there would be sufficient funding to contribute to teaching to alleviate this problem. However, as it currently stands, the two problems are linked, and teaching programs will continue to suffer from a lack of support at the present student numbers. We continue to look for areas in which we can improve the efficiency of delivering the college curriculum to reduce expenses as far as possible.

At the level of departmental academic support costs, an ongoing problem is the economic inefficiency inherent in smaller departments. The departments in the College range from 15 – 37 faculty and oversee budgets of 8 to 16 million dollars at present, yet each requires an MSO, computing support, etc. Furthermore, since extramural funding has a significant impact on the distribution of additional support revenues to the departments, the small departments are disadvantaged in total revenues and also more subject to random fluctuations in revenue from year to year. Two approaches to dealing with this problem are possible. The first is to create
clustered support functions; in one example of this, the two smallest departments are sharing a computer support person. While not optimal, this is a reasonable accommodation to financial pressures. The second approach is to attempt to more closely balance the size of the departments. This is of course dependent on academic priorities, and the desire of the faculty of the College to devote positions to particular disciplinary areas. One long term proposal in CBS is to take advantage of the extant distribution of disciplinary strength in genetics across one large and one small department (Molecular and Cellular Biology, and Microbiology), and to gradually replace retirements in this area in the larger department with hires in the smaller department, until the size of Microbiology reaches an efficient level (~20). This major is currently administered by MCB, with teaching contributions from three departments, but with the approval of the faculty and academic senate, it could eventually be relocated to the unit with preponderance of faculty working in this discipline.

A final resource issue facing the College is the changing parameters governing appointments in the Agricultural Experiment Station. The most senior faculty in CBS have permanent tenured appointments in the AES with associated 11 month appointments. The next most senior cohort have 5 year renewable term appointments; both permanent and term appointments are subject to review but the term appointments are not tenured. Finally, the most junior faculty in all departments (and all of the faculty in the Center for Neuroscience and in the Exercise Biology group in NPB) have nine month appointments and no affiliation with the AES. Recently, the stringency of the process by which faculty are evaluated with respect to how well their research programs fulfill the criteria of the AES (relevance to agriculture and agricultural outreach being the key determinant) has been significantly increased. As a consequence, certain programs that were previously acceptable are now failing to obtain approval, placing the continuation of the AES appointments in jeopardy. This has created a potentially significant problem, in that it is not clear how to deal with senior faculty tenured into the AES whose research programs are meritorious with respect to the I&R component of their appointment but not approved for the AES component. There is also an issue with the faculty in the term appointments, who have seen the criteria under which they were initially hired into the AES changed with potentially significant impacts on their salary. During the next five years, we will work with the Associate Director of the AES and the campus to develop suitable options for addressing these issues.

B. STRATEGIC PLAN FOR RESEARCH: — Sustaining excellence in a changing world.

1. Mission Statement

College of Biological Sciences faculty and their students investigate an extraordinary array of research problems, ranging from the structure of molecules to the organization of ecosystems, and from the evolution of life forms to the diversity of the biosphere. Our programs are internationally recognized as a result of many years of continuous investment. Our mission is to support the highest caliber basic biological research, emphasizing interdisciplinary efforts that enable new research paradigms. Basic research will continue to have a major impact on understanding and treating human disease, on the maintenance of an adequate supply of healthy food, and on creating a sustainable environment.

2. Background
A new set of organizing principles define the biological sciences today: comprehensive compilations of the building blocks of life in a wide array of species, elucidation of biological pathways, and the existence of complex networks of interacting molecules, pathways and organisms. Currently biologists are seeking to expand the scope of their studies. The goal is no longer limited to simply describing the mechanism of basic processes, but now extends to placing what is learned into the context of a larger biological frameworks or biological systems. This transition has been precipitated in part by the maturity of many biological fields and in part by the technologies of genomics and proteomics, which have irrevocably changed how scientists approach biological research. Cross-disciplinary approaches are now required to advance research in all aspects of biological sciences. Biologists are increasingly turning to the physical sciences: mathematics, chemistry, engineering and physics, to attain a complete understanding of biological pathways and networks.

CBS is already strong in both focused and interdisciplinary research in the biological sciences. However, sustaining this strength while remaining at the leading edge of this rapidly evolving discipline requires that the College continue to invest in hiring young faculty with expertise in what is often termed “systems” or “network” biology, while ensuring that fundamental disciplines remain strong. The College and department academic plans reflect this dichotomy of purpose, with proposals for enhancement of strength in a few key areas described below, accompanied by plans for sustaining or rebuilding strength in areas critical to the research and teaching missions of the College. Sustained efforts are also required to effectively continue our efforts to increase the diversity of our faculty.

3. Proposed Plan of Action

The College is entering a phase of very limited growth, with a primary focus on achieving sustainable excellence. Our hiring plans will thus be predicated on strategically replacing retiring faculty, with some limited participation in ongoing campus-wide initiatives. Stable revenue streams must be identified that will enable this strategy to succeed, given the burgeoning societal needs in areas our students pursue, such as the health care professions and biotechnology. We remain mindful that recruitments must succeed in hiring faculty with the ability to teach specific rapidly-growing areas of biology to undergraduate and graduate students, while simultaneously strengthening our research portfolio. One result of this need, which is already reflected in the practices of the College, is that teaching in the majors frequently crosses over departmental boundaries, allowing hiring to be somewhat disengaged from the number of majors in each discipline. We therefore will encourage departments to coordinate their recruitments when possible. CBS has also benefited greatly in the past from collaborations in hiring outstanding new faculty with joint appointments, leading to better integration and collaboration between colleges across campus. Given the increasingly common interests of basic biologists in CBS and of faculty in the Colleges of Engineering, CA&ES, and in the School of Medicine, it appears profitable to enhance these collaborations even further during the next five years.

Below we discuss two high priority areas for recruitment in which multiple departments in the College share a common interest, leaving to the detailed departmental academic plans numerous important proposals for more narrowly targeted searches aimed at sustaining specific areas of excellence and curricular importance. The College proposes to carry out several searches in each of these two key areas, leveraging when possible overlapping departmental interests, in addition to searches targeting strategic areas of importance to specific departments. These searches will predominantly involve the replacement of retiring faculty, with growth limited to at most 1-2 positions per year if possible.
The two areas of overlapping departmental interest can be simply described as “how did life evolve to its current state and what can we learn from that?” and “how does it all work?”

**Evolutionary and Comparative Genomics.** To understand how life works, we must understand how it developed from primitive ancestral forms. Studies comparing different life forms not only tell us about the past, but are also critical in understanding the diverse life strategies that have developed under evolutionary pressure. Enormous benefit can be gained from learning about this diversity, including information critical in developing strategies to deal with a rapidly changing environment.

Over the past few years, there has been an explosive increase in data derived from the genomes and proteomes of organisms in all branches of the tree of life, including plants, animals and microbes. This has created a remarkable opportunity to use comparative genomic approaches to advance many areas of biological research, ranging from questions about evolutionary processes and the diversity of life forms to studies of the molecular characteristics of modular functional domains in families of proteins and the detection of sequence motifs regulating gene expression. The methods used in comparative genomics also span a broad spectrum, from purely computational approaches to large-scale gathering of structural and functional genomic data using high throughput molecular technologies. CBS, with its broad representation of faculty working in all of the areas mentioned, its historically strong reputation in evolutionary biology, and the technological and intellectual resources developed in conjunction with the Genome Center, is well suited to provide a home for new faculty appointments in the area of comparative genomics and evolution in all kingdoms of life. The addition of such faculty would ensure that the College is in a position to take full advantage of the next era of genomics: the creation of an integrated view of the mechanisms of life arising from a full understanding of the relationships between different life forms.

**Biological Networks/Systems Biology/Integrative Biology.** Basic research in the biological sciences over the last century has defined the “parts list” of life, from molecules to ecosystems, and has revealed many of the detailed mechanisms governing the function and behavior of these parts. Accumulation of such data has accelerated dramatically in the last decade with the advent of new technologies. The challenge for the next century is to understand how the parts work together; i.e. the intricate and integrative relationships between the multiple parts of functional systems at every level; from molecules to systems and processes within cells and organisms, to the relationships of organisms within populations and communities, and even to the interactions between communities.

A common feature in this area of research is the importance of computational and quantitative approaches to defining the networks, whether the focus is on either the generation or analysis of large datasets (or both). Computational approaches are necessitated by the enormity of biological data sets, the increased ability to detect and measure complex and dynamic interactions, and the multi-dimensionality and interconnectedness of processes across multiple levels of biological organization. This area of biology is very interdisciplinary, with a rapidly growing interest among mathematicians, physicists, computer scientists, and engineers in the complex systems and databases of the life sciences. The searches proposed across various departments of the College that fall into this category span from comprehensive analysis of molecular interactions in plant, animal and microbial systems, to metabolic, transcriptional and signal transduction pathways, into computational analysis of the behaviour of the nervous system and onto the ecology of large scale phenomena. Hiring across campus in this area has been carried out under the Computational Characterization and Exploitation of Biological Networks initiative. The College recently completed one recruitment under this initiative, and a second is planned in the area of systems biology/network analysis (most likely in the Department of Plant Biology).
Although deep and broad strengths in quantitative biology already exist in several units across campus, this is an area of rapidly increasing importance and will be an essential part of future teaching and research in the College. Increasing our strength in this area will require the recruitment of faculty with combined strengths in quantitative/computational and experimental biology. Faculty recruitments having this specific combination of research experience will foster unity among diverse areas of interest and lead to cross-departmental interactions and collaborations. The College is a uniquely qualified home for the continued recruitment of faculty employing interdisciplinary biological approaches.

**Other areas of excellence.** The disciplines discussed above represent areas of common interest across the College, but there are several other areas of current relevance in which the campus has invested substantial resources in a quest for excellence. One of these, the use of new imaging and computational technologies such as cryo-electron microscopy for structural and bio-nanotechnological studies, is of common interest to the College of Biological Sciences, the College of Engineering and the School of Medicine. Given the substantial cost of the instruments involved, it is imperative that the various units cooperate strategically in future hires to assure a maximal return on past and future investments in this area.

In addition to the areas mentioned above, the College has well developed strengths in areas such as cell biology, plant and animal biochemistry, microbial diversity, single molecule biophysics, and neuroscience. Emerging areas identified by the departments that will require further investment to thrive include stem cell biology, muscle physiology, microbial pathogenesis, behavioral endocrinology and the ecology of large scale phenomena.

In three areas, previously initiated efforts are still underway. These include the completion of an agreement with the campus to build the Muscle Biology program within the former Exercise Biology Program, which became fully integrated into the Department of NPB in 2005-06. Four faculty have been recruited in this area since 2003 bringing the total faculty in this group to six, with 2 additional hires planned when resources can be identified. Proposed areas of emphasis for these recruitments include the areas of metabolism and endocrinology as related to the physiological impact of exercise and inactivity. The study of muscle (skeletal and cardiac) is interdisciplinary and has far reaching applications to physical well being, health and disease. The muscle biology group will also strengthen the current physiology core within NBP which is critical for continued excellence in the teaching and training of students interested in health science careers. A second unfinished effort is hiring under the Global Environmental Change initiative; one recruitment under this initiative has been completed, and a second is planned to recruit an organismal biologist who investigates phenomena operating at landscape and/or global scales spatially, as well as over evolutionary time scales (most likely in the Department of Evolution and Ecology).

4. **Metrics of Success**

a. **Faculty publication rates.** A general metric of success in research is the number and, more importantly, the quality of the publications, including successful patent applications, generated by the faculty. The number of publications in high-impact journals including *Science, Nature, Cell,* and the *Proceedings of the National Academy of Sciences* is one metric of faculty excellence that can be tracked.
b. Extramural funding for faculty members. Another important metric is the amount of extramural funding, in particular funding obtained through peer-reviewed competitions. While it is critical to have up-to-date information on total awards in the College, the most important metric is the success on a per faculty basis. Professional awards, elected membership in professional associations, and invitations to present prestigious lectures are additional indicators of the prestige and status of our faculty members. The differences in publication style and funding environment between the different fields represented by the College must be taken into account before attempting any comparative analysis between individual units.

c. Number of career young investigator awards for new faculty. Of special importance is to track the success of the newly hired, and in particular junior, faculty. Besides the general metrics discussed above, awards to junior faculty such as Searle, Pew, Sloan and PECASE are an excellent indicator of their relative standing within their peer group. The mentoring of junior faculty and tracking of their success in research requires special attention.

d. Success of faculty recruitments. Monitoring the success of the faculty recruitment process is critical to ensure that the College remains an attractive venue for the most talented faculty. We track departmental success in recruiting first choice candidates, as well as tracking the diversity of college hires. In searches where candidates declined the UC Davis offer, the chair of the search committee completes a standard questionnaire including reasons leading the candidate to decline the offer.

e. Retention of the current faculty. To sustain the excellence of our programs, it is critical that our best faculty be supported and appropriately recognized to ensure that they are not recruited away by competing institutions with deeper pockets. This requires diligent attention to the needs of these faculty, and increased efforts to generate sources of support such as endowed chairs and professorships. Over the past five years, we have successfully retained more faculty than were lost to other universities, but in the current budget climate, we will need to redouble our efforts.

f. Number of newly-funded interdisciplinary research grants. An important goal is to increase the number of interdisciplinary research endeavors. Collaborations between CBS faculty, and between the faculty in CBS and other campus units will be tracked. The metrics of success in fostering interdisciplinary research include the number of interdisciplinary research grants and publications as well as the number of jointly authored publications and patent applications.

C. STRATEGIC PLAN FOR TEACHING — Undergraduate, Graduate, and Public Education

1. Mission Statement

UC Davis is one of the world’s foremost universities conducting research in the life sciences. In an era when rapid advances in biology are changing all facets of the human experience and are an essential prerequisite to meeting future challenges in health care, food and energy production, and environmental change, it is self-evident that biology-oriented teaching should be a major focus on our campus. The College of Biological Sciences will continue to be the primary unit providing comprehensive and fundamental teaching in the life sciences at UC Davis.

Teaching and training in the biological sciences are especially challenging for the following reasons. First, fundamental knowledge of biological processes is expanding at an ever-accelerating rate, creating a constant need for course revision, curricular re-invention, and even changes in how courses are
administered between different departments. This explosion of information requires us to place more and more emphasis on critical thinking and problem solving in our curriculum, rather than on the dissemination of facts. Second, an unusually large portion of this new, fundamental knowledge is directly relevant to the public, as well as to those pursuing careers in the life sciences. Affordable personal genome sequencing is not far off, with large and unpredictable consequences for society, and careers in life sciences continue to expand and diversify, placing high enrollment pressure on our courses. Third, developing our students’ essential analytical skills requires intensive teaching, especially at the upper-division level, often involving a combination of laboratory work, hands-on problem-solving, and writing. These activities are inherently more costly than traditional lecture format courses, yet are an integral component of adequate preparation for careers in the life sciences.

Faculty within CBS embrace the importance of our teaching mission at three academic levels: teaching undergraduates preparing for life sciences careers, training the next generation of biological scientists at the graduate level, and helping to engender a scientifically literate public. Our strategic goals for each of these teaching missions are briefly outlined below.

2. Background

a. Teaching undergraduates preparing for diverse careers in the life sciences. UC Davis is one of the top producers of graduates in life sciences in the nation, and thus our undergraduate curriculum will impact the culture of biology nationally and internationally. Career options in life sciences continue to grow and diversify, and this is reflected in our undergraduate teaching mission. CBS and its component departments currently sponsor nine academic majors, and there are over 5,000 undergraduate students within these major programs. However, it is important to stress that our undergraduate courses provide teaching in fundamental biology for almost all life sciences-oriented undergraduate programs across campus. Approximately 43% of the students enrolled in the Bio Sci 1 ABC core sequence, for example, are not majors within the College (Appendix IIIA). At the same time, the number of CBS undergraduate and graduate students has shown a marked increase over the last five years (Appendix IIIB).

Because of our campus-wide teaching role, efforts to improve curriculum within the College must serve the needs of many programs across campus. This is a daunting task, given the diversity of those programs, ranging from Biotechnology to Wildlife, Fisheries, and Conservation Biology. Nonetheless, we believe that the ongoing revolution in biological knowledge demands innovative new approaches to teaching. Biological information is growing at a greater-than-exponential rate, making it impossible to provide both comprehensive breadth and depth of understanding in any core curriculum. The explosive growth of information requires a greater emphasis on the ability to analyze information critically and to think synthetically.

Laboratory research experiences have a transformative impact on undergraduate students, and the College continues to emphasize the importance of working in faculty labs for all motivated students. Almost every faculty member in the College has mentored undergraduate students in laboratory research. In addition to locations on campus, students have an excellent opportunity to experience research at the Bodega Marine Lab through the Undergraduate Marine Biology Quarter in the Spring or the NSF-supported Summer Research Experience for Undergraduates.

b. Teaching and training at the graduate level. UC Davis is an international leader in training scientists in biology, and in 2005 (the most recent available data), it was ranked first in the nation for the
number of doctorates (140) granted in the biological sciences (from the NSF/NIH/USED/NEH/USDA/NASA Survey of Earned Doctorates; http://www.nsf.gov/statistics/nsf07305/pdf/tab12.pdf). CBS plays a central role in this training effort, currently sponsoring ten graduate groups, with 515 enrolled students. Cross-disciplinary interactions across the entire campus are fostered by three interdisciplinary Centers and by six major training grants administered by the College.

Over the next five years, our broad goal is to continue to strengthen our campus’ international reputation for graduate training in the fundamental life sciences. UC Davis is currently highly regarded in several disciplines that have homes within the College, and we plan to continue our international leadership in these areas. We plan to leverage recent investments by the campus in the interdisciplinary fields of genomics and bioinformatics through development of a graduate program in Bioinformatics; however, our efforts are hindered somewhat by the current budget situation. Recent cuts have seriously strained our graduate training and faculty recruitment budgets, leaving virtually no financial buffer and making new investments hard to sustain. Accordingly, our short-term strategic planning emphasizes ways to pool resources and to minimize redundancy across our training programs, while continuing insofar as possible to support new program development.

c. **Supporting the development of a biologically literate public.** Through the internet and mass media sources, the public is being barraged by news (both reliable and not) about new biological discoveries and theories. Increasingly, the faculty members in CBS see that it is a vital part of our teaching mission to help students in all disciplines to be critical consumers of biological information. Non-scientists need to learn enough about biology and about the process of scientific discovery to assess the validity, benefits, and risks of scientific claims that affect their lives. Similarly, as biological sciences play a larger role in human affairs, it is critical to enhance the ability of scientists to communicate with non-specialists. To achieve these goals, the departments of the College continue to develop and offer courses that engage non-majors in the excitement of biological research. Among the new courses recently developed are courses on Biodiversity, Ecology, and Life in the Sea. Furthermore, the faculty of the College will continue to speak out in open forums to bring biology to the public. Given the continuing need for increased public support of the University’s mission, it is important to remember that informed voters are more likely to be supportive voters.

3. **Proposed Plan of Action**

a. **Undergraduate Education**

1) **Revision of the core curriculum series to increase emphasis on problem-solving and critical thinking.** We have completed the development of an innovative, new core sequence during this past year, and will offer the final quarter of the new series for the first time in Fall 2008. This new series, developed and taught with contributions from our colleagues in the CA&ES, is at the cutting edge of modern biological thought; organized along the major themes of origin, evolution, and the diversity of life rather than the classical (and now dated approach) of following the several kingdoms of life. For the post-genomic era, when the unity of life has been made abundantly clear through the comparison of genomic DNA sequences, this new curriculum will prepare our students for biology in the 21st century. In the coming years, we will continue to fine tune this new curriculum, as well as focusing our efforts on developing innovative pedagogical approaches to ensure that the students in these very large lecture courses become excited about biology, as well as learning and more importantly retaining the material.
2) **Increase the quantitative skills of undergraduates in life sciences.** Careers in the life sciences increasingly require the type of symbolic thinking that is embodied in mathematical models, as well as quantitative analysis based on applied statistics. To complement the new core sequence, we have initiated development of a series of web-based courses focused on the application of mathematical models to biology. With support from the campus and the Howard Hughes Medical Institute, we were able to develop and offer the initial core course in this series (BIS 20Q) and to develop several upper division companion courses in quantitative biology. However, our goal of requiring all majors in the College to take the 20Q course as part of the core curriculum proved difficult to implement at this time. Although there is a widely accepted need to better prepare our students for quantitative biological approaches, the College is unable under present budgetary constraints to provide the additional permanent teaching assistant support needed to deliver the course to all students. We are committed to finding permanent extramural and campus support to implement this curriculum, which is critical for the preparation of our students.

3) **Ensure that all Biological Sciences majors incorporate courses that build the writing and/or speaking skills of undergraduates.** Many of our faculty members are alarmed by the deterioration of communication skills in students entering our programs over the past ten years. Given the importance of written and oral communication among scientists, as well as between scientists and the public, the College will work to increase the emphasis on these skills in its course offerings, especially in freshmen seminars and at the upper division level, where smaller class sizes make this intensive teaching approach feasible. Staffing a sufficient number of these courses to meet our teaching goals and implement the writing components will require substantial re-investment after the current budget crisis eases.

4) **Increase curricular flexibility for Biological Sciences majors.** We have completed during the past year a revision to the upper division core curricular requirements affecting more than half of the students in the College, depending on their major. This change reduced the required core units for these students while still meeting their needs for preparation in the core disciplines, and provides them with more flexibility in designing their upper division course-work and including additional electives in their course load. We will continue to look for ways in which our students can acquire the depth of expertise they need to succeed in their area of emphasis, while still being able to experience the full breadth of educational opportunities in liberal arts available at UC Davis.

5) **Provide advanced undergraduates with more options to take challenging, hands-on courses that emphasize problem-solving, analytical techniques, synthesis, and writing skills.** Courses with these characteristics are faculty-intensive and require small class sizes to be effective. Nonetheless, we feel that they are an essential part of a world-class education in biology, and we are committed to providing them at the upper division level. These classes are most vulnerable to the ongoing budget crisis, and we must develop new strategies to provide a sustainable source of support. One source of support can be training grants that provide exceptional learning opportunities for advanced undergraduates. A new, intensive undergraduate training program in mathematical biology (CLIMB, Collaborative Learning at the Interface of Mathematics and Biology) was recently funded by the NSF, and is being run on a year-round basis in the Department of Evolution and Ecology.

6) **Enrich the learning environment for highly motivated undergraduates.** CBS faculty members have a strong tradition of involving undergraduates in research, and our capstone courses reinforce the importance of being an active participant in creating new knowledge. We are considering further ways to
attract top students in the biological sciences to matriculate at UC Davis, including an ongoing proposal to develop an honors curriculum. The faculty-developed proposal for a CBS honors program is presented in Appendix IV. This four-year honors program would be aimed at a selected group of freshmen, with enrollment restricted to 50 outstanding students in the incoming freshmen class. The program is proposed to include a freshman seminar, a research course, an introduction to the research programs of our faculty, a thesis research project and a capstone course where students will demonstrate their writing and communication skills. The program will be designed to encourage synthetic thought, understanding of intellectual contexts, quantitative reasoning, and accurate data analysis. Although this proposal was first made three years ago, progress in implementation has been limited due to a lack of identifiable resources that can be committed to covering the costs associated with offering the curriculum. We remain dedicated to moving forward, however, as we feel that this is an important opportunity for our top incoming students, and will be helpful in attracting them to matriculate at UC Davis.

7) **Initiate the planning process for supporting the undergraduate program in the new School of Nursing.** It is anticipated that the Betty Irene Moore School of Nursing will launch a bachelor’s of science in nursing program in 2010 or 2011. We expect that at least some part of the curriculum for this program will include courses in the biological sciences, and we look forward to working with our colleagues in developing and supporting the necessary courses. Although it is not yet clear precisely how the curriculum will be designed or how many students will be involved at the outset, it is important that we start during the next year to both develop the courses, so that they can be approved through normal college and academic senate procedures in a timely fashion, as well as identifying any infrastructural or resource needs that will be required for delivering this curriculum.

b. **Graduate Education**

1) **Increase efficiency in graduate group organization.** The faculty of the Biochemistry and Molecular Biology (BMB) and Cell and Developmental Biology (CDB) Graduate Groups are currently considering a merger of the two groups. Given the substantial overlap in disciplinary areas and requirements, this merger would provide administrative efficiencies with very little impact on curricular and research training programs. Given the finite financial resources available to support graduate education, and in an era when CBS and the campus are hoping to increase graduate enrollment, it is important that we identify and explore all possible options to increase efficiency.

2) **Increase curricular flexibility for graduate students by reducing required lecture courses and emphasizing seminars and journal clubs.** While we recognize that some core courses are vital, our major effort should be focused on developing the critical thinking skills of our graduate students. This goal is best achieved through journal clubs and seminars in which students must critically evaluate primary literature and present their synthesis to an audience of their peers. In the past, increased efficiency in core course delivery has been achieved through development of common core courses shared by multiple graduate programs. Recognizing that this is not always possible, we should nonetheless explore every possible opportunity to integrate courses across group boundaries. In this era of increasingly interdisciplinary research, it is more important than ever to for the curriculum to cross disciplinary boundaries and move beyond the more defined courses of the past.

3) **Increase the ability of our graduate students to teach and to communicate to non-specialists.** We need to reinforce the fact that teaching and research are synergistic activities that create more innovative and communicative scientists. Some of our graduate groups already require some teaching by all graduate students, and we continue to consider applying this requirement to all groups administered.
by the College. There are many potential opportunities for graduate students to gain teaching experience at all curricular levels, given the intensive nature of teaching in biological sciences. However, these opportunities are seriously constrained by cuts to the temporary teaching budget of the College of Biological Sciences, which is one source of support for teaching assistantships. Sustained support for teaching assistants is critical to both training of our graduate students, as well as to maintaining excellence in the undergraduate curriculum in the life sciences.

Given current budget constraints, we will consider some creative ways to involve graduate students who are principally supported by extramural grants in our teaching enterprise. To provide training and tutoring options for graduate students, our graduate-level “Teaching conference” courses (390 courses), now used principally to give TAs credit for extra time spent meeting with faculty instructors, can be expanded to include graduate student tutors without formal TA positions.

4) **Identify emerging research areas that can serve as the foundation for multi-disciplinary training grants.** Modern research in biology increasingly requires collaboration across traditionally separate disciplines. Within the CBS, faculty are encouraged to review calls for multidisciplinary training grant proposals, and we will endeavor to catalyze the development of such programs within the College and across the campus. Our goals are to provide funding to increase the number of graduate students, to train graduate students experienced in multidisciplinary collaborations, and to increase the diversity of our graduate student body. Recruiting the best graduate students in the life sciences to UC Davis and increasing the relative number of graduate students are both dependent on the acquisition of new funding, particularly to support the first year of graduate education, when many of our students rotate between labs, and cannot be paid from extramural grant funding. Such rotations are a hallmark of the strongest programs nationwide.

c. **Public Education**

1) **Increasing our offerings of integrative introductory courses for non-majors.** Providing this broad-based educational service has at least three very positive effects. First, as we attract more students into these courses, we elevate their understanding of the fundamental biological processes that profoundly influence human health, agriculture, and the environment. Second, we expose these students to the critical thinking and hypothesis-testing, which underlie research in life sciences. Third, both faculty and graduate instructors gain experience in effective ways of communicating to non-specialists. A challenge in offering such courses is the budgetary commitment necessary to instruct the course and to provide teaching assistant support. This is only economically viable if the course enrollments are large; thus, it is necessary to be very judicious in designing such courses to attract significant numbers of non-majors, which is often difficult in the first years a course is offered. Another pathway for introducing non-majors to topics of current interest in the biological sciences, in a small class size format, is Freshman seminars. We are committed to increasing the number of such seminars taught by our faculty.

2) **Increasing opportunities for minors in biological sciences.** The recently introduced Interdisciplinary Minor in Quantitative Biology and Bioinformatics, offered in cooperation with the College of Engineering and the College of Letters and Science, offers a unique opportunity to help students in many majors prepare for interdisciplinary research or employment opportunities. We encourage the development of similar minors in other fields of biology, given the great need for preparing students in many disciplines to thrive in the current scientific environment.

3) **Supporting educational opportunities in the public arena.** College faculty are encouraged to
participate in any possible opportunity to educate the public about issues in modern biology. Recent examples include participation by faculty in local public radio programs such as “Insight”, presentations at public gatherings such as recent talks on evolution at the Sacramento Zoo, and invitations to the local community to participate in events such as the lectures sponsored by the Storer Endowment. One area in which the College has room for growth is in doing a better job of publicizing the relevance of its research programs more effectively in the local and national print and broadcast media. This is a greater challenge for research in basic as opposed to applied fields of biology, but with effort and attention to creating interesting and approachable content the College could likely increase its role in educating the citizenry through media outlets.

4. Metrics of Success

a. Initiatives to enhance the education of life sciences majors. Our strategic plan for improving our education of undergraduate life sciences majors centers around three major goals. Our first goal is to increase the flexibility and efficiency of our undergraduate curriculum in biological sciences through revisions of the first-year core curriculum and the reduction in the number of 100-level courses required for some majors in the Biological Sciences. As we fully implement the new core sequence in the 2008-2009 academic year, we will test the effectiveness of our new approach by tracking the proportion of life sciences students who complete the core series. We have been studying this metric in the old core, specifically in relation to the impact of completion rates in the core courses in biology and chemistry on diversity of the college student body in the upper division. It will be of interest to follow any changes resulting from transition to the new core.

Our second major goal, which will be advanced by greater curriculum flexibility, is to provide motivated life sciences undergraduates with more opportunities for taking challenging, hands-on upper division courses, and for participating in an enriched Honors program. Over the next five years, progress in this area will be indicated by increases in intensive upper division course offerings within the College, increased enrollment in these advanced courses, and the launching of an Honors program. Our third and perhaps most important goal will be to enhance the ability of our majors to solve complex problems, to think analytically and synthetically, and to be effective communicators. Measuring success in this area presents challenges, and we are discussing several options. At the very least, as the new curriculum is phased in, we will periodically assess faculty perceptions of how curricular changes are affecting the preparedness of students enrolling in more challenging courses, and the College core curriculum committee will use this data to make further changes in the core as needed. In addition to this approach, we recognize that the next five years will provide a unique opportunity for directly comparing the skills of students enrolled in either our past or new core curriculum. We hope to work with researchers in the School of Education to design a study that will allow us to measure the pedagogical effectiveness of our new approach to teaching introductory biology.

b. Improving training of graduate students. Our major goals in this area are to increase the flexibility of graduate curricula and the diversity of course experiences for graduate students, to provide graduate students with more training in teaching and other career skills, and to continue to develop more sources of financial support for research training. One measure of our success in enriching graduate curricula will be an increase in the number of small-group journal clubs and seminars being offered to students in graduate programs within the College, as well as increased enrollment in those courses. The most important gauge of our efforts to increase support for interdisciplinary graduate training will be our success in attracting extramural training grants. Most recently, faculty in CBS have provided leadership in obtaining funding for a training grant in Neuroscience from the NIH, and for an IGERT grant.

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c. **Increasing education outreach to non-majors and to the public.** Over the next five years, we aim to increase the diversity of UC Davis students who are being exposed to important fundamentals of biology by offering an expanding array of compelling non-majors courses, and by providing students with an opportunity to minor in biological sciences. We will measure our success in achieving the first of these goals as increases in the number of highly-rated non-majors courses being offered and increased attendance in those courses. Student evaluations and interviews with peer advisors will be important components of our effort to refine and improve these course offerings to better serve the needs of the broader student community. We will make progress towards the second goal by initiating and publicizing a minors program that will allow motivated undergraduates to formalize their multi-disciplinary training. Moving beyond the university itself, we aim to increase the role of the College in educating the public about fundamentals of biology as well as about important advances in biological research. These efforts, and measures of their success, are detailed in outreach section of this Academic Plan.

D. **STRATEGIC PLAN FOR OUTREACH — Facilitating Communication**

1. **Mission Statement**

Outreach has many meanings in an academic context. For the purposes of this Academic Plan, we will define outreach in the context of each of the several target groups for outreach efforts. For each of these targets, we present goals, suggestions for implementation, and a statement of the metric that will be used to assess the success of the outreach effort. The outreach target groups we have identified are (1) communities outside of the University, local and national media, extramural funding agencies and potential private donors, (2) undergraduate, graduate students, and postdoctoral fellows, (3) upper level administration, (4) faculty at UC Davis but outside of the College, and finally (5) faculty within CBS.

2. **Background**

a. **Outreach efforts to the public.** Like all units of the University, CBS has a responsibility to maintain a positive relationship with the public. Such a relationship can be achieved by personal interaction and effective communication with the general public, as well as with students and colleagues at other universities. Outreach to the public is important not only because it relates to our accountability as a public institution, but also because it helps maintain support for the University. Measures to increase effective outreach are described below.

A majority of CBS faculty members have partial appointments in the Agricultural Experiment Station (AES). An aspect of the AES is to conduct agriculturally and environmentally relevant research of importance to the people of California and to make that research available to them. Outreach in this context relates to stakeholders including governmental agencies, organizations representing California agricultural and business interests, environmental groups, and biotechnology and pharmaceutical firms. Mission-oriented research in AES should also meet the needs of identifiable clients, the identity of these clients, such as the citizens of California, members of one’s profession, students and others, and suggestions on appropriate ways to reach them are outlined in the CBS AES Outreach Plan (See Appendix V).
b.  **Outreach efforts to undergraduate, graduate students, and postdoctoral fellows.** Sustaining the commitment and enthusiasm of the undergraduate and graduate students and postdoctoral researchers currently enrolled in our majors or working with faculty in CBS is another important aspect of the outreach efforts that need to be made by CBS. We can do this by providing them with an outstanding curriculum, effectively communicating to them the efforts underway in the College to keep their curriculum on the cutting edge of science, and by preparing them well for productive and fulfilling careers in research.

Particular efforts have been made in outreach to undergraduate and graduate students from diverse and disadvantaged backgrounds, with a focus on increasing representation and retention of students in the biological sciences. With funding from the Howard Hughes Medical Institute and the National Institutes of Health, the Biology Undergraduate Scholars Program (BUSP) and the Initiative for Maximizing Student Diversity (IMSD) programs have created enrichment programs for these students that incorporate additional mentoring, supplementary coursework, laboratory research placement and funding and a variety of group activities designed to improve skills ranging from presentation of research results to preparing for interviews for graduate school. These programs have proven very successful in increasing the number of students completing degrees in biology and in enhancing their performance and success.

Outreach to students currently not enrolled in CBS majors is also an important component of our outreach program. Making these students aware of educational opportunities in CBS, either as participants in our majors and minors or as students taking a course designed to meet the curricular needs of non-CBS majors in some area of biological science may persuade them to pursue degrees in CBS -- or at the very least, to become more informed citizens regarding biologically relevant issues. Specific goals include attracting new students to enroll in our majors and increasing the number of non-CBS students taking courses taught by College faculty.

c.  **Outreach efforts to the upper level administration.** Another important goal of this outreach effort is to communicate effectively with the central campus leadership to ensure that they are aware of the contributions made to the campus by the CBS. This is crucial in order to ensure that CBS is recognized for its accomplishments and to maintain the level of campus support necessary to sustain future excellence.

d.  **Outreach efforts to other academic units.** Sustaining and enhancing meaningful and productive relationships with faculty in other colleges and departments and effective communication to these colleagues of information regarding current events in CBS is also important to establish a strong research community on the UC Davis campus. Strong ties with established as well as newly created Centers that transcend college boundaries are also critical to taking full advantage of the opportunities for interaction across campus. Faculty with appointments in four of our five departments are housed in one of three Centers or ORUs (Genome, Neuroscience, Bodega) and provide an important line of communication between the College of Biological Sciences and the other colleges.

e.  **Outreach efforts to College faculty.** Outreach efforts must also extend to our own faculty. UC Davis is rich in many diverse areas of research, and CBS itself includes faculty with widely diverse research interests. The ability to facilitate communication between faculty, postdoctoral researchers and students within CBS and throughout the entire research community of UC Davis will allow for the unveiling of common research interests between diverse programs, and contribute to the formation of a more interdisciplinary network of scientific research as a whole.
In this context, the primary goal of outreach efforts involving College faculty is to increase the level of communication among all faculty, particularly between the faculty members in different Departments. Increasing the familiarity of faculty with the research programs of their colleagues in the College enhances the possibilities for cooperative efforts in research, maximizing the utility of existing resources and facilitating the development of joint funding efforts such as program project grants. Outreach within the faculty of the College should extend to teaching as well as research. The reorganization of the core curriculum and the increasingly interdisciplinary nature of modern biology make it imperative that the level of curricular cooperation between the Departments be increased, and this is only possible if faculty become more aware of the teaching programs developed by their colleagues across the College (as well as the campus).

Communication between faculty in different departments was greatly enhanced when the College was formed three years ago due to the establishment of the CBS Faculty Executive Committee, with nine elected and four ex officio members representing all departments as well as the CBS Dean’s office. This committee provides a forum for shared governance of the College and for exchange of information and discussion regarding programmatic issues.

3. Proposed Plan of Action

a. Outreach to communities outside of the University: the general public, the media, funding agencies, and private donors. Public outreach occurs in a wide variety of forums and faculty and students should be encouraged to participate in such efforts as often as possible. The College can assist by developing mechanisms for matching appropriate faculty with outside groups, and by drawing attention to such activities when they do occur. In addition, CBS can partner with other groups on campus that regularly do public outreach events, and can sponsor or participate in these events. The College needs to continue to improve its efforts to generate media reports about research accomplishments and other notable achievements of College faculty. Also, publicizing recipients of prestigious fellowships, awards, papers in high-impact journals, etc. is important. It is critical to widely publicize examples of College faculty with notable achievements, and it is incumbent on us to work more closely with the central campus news service to release more stories about the activities of College faculty. A critical prerequisite is improving our skills at translating basic biology research discoveries into topics understandable and interesting to the lay public. Another aspect of this would be development of a better “experts” list of College faculty who could comment on topics of public interest.

Faculty should be encouraged to participate in events (e.g. conferences) that raise awareness of College research programs with funding agencies. If there are opportunities to invite individuals in leadership positions at the funding agencies to speak at UC Davis, the College should encourage the faculty to extend such invitations and provide opportunities to do so.

Better tracking of College graduates entering high paying careers (biotech, medicine) might lead to better maintenance of lines of communication and encourage future gifts. The Dean should engage particularly effective faculty in meetings with potential donors, and the faculty should agree to participate if asked.

b. Outreach to the students.
1) **Students in the College.** The primary interface between the College and our undergraduate students is our advising staff. We are fortunate to have excellent and committed staff in our advising offices, and it is imperative to support and maintain the services provided. During a time period when efforts have been undertaken at the College and Departmental levels to revise the core curriculum as well as the requirements of the majors, it is critical that mechanisms be established to ensure that the advising staff are kept abreast of both the details and the rationale for changes to the curriculum so that they can effectively communicate these changes to their advisees in a manner that transmits a message of enthusiasm and excitement.

Outreach to undergraduate students of the College should continue after their graduation through organized tracking and communication efforts. We have now specifically tasked a staff member in the development effort to begin coordinating alumni activities with future graduating students. By engaging with them during their time at Davis, it is our hope to create a system that will help us engage with and track students after graduation. This will increasingly involve web based and cell phone based means of communication, given the increasing mobility and tendency of students to avoid land line based means of communication.

Outreach to graduate students and postdoctoral researchers is equally important for CBS. Creating venues for graduate students and postdoctoral researchers to interact and to exchange scientific ideas is important in fostering a more interdisciplinary environment within CBS. This might be accomplished through annual CBS retreats or one-day picnics that would allow graduate students and postdoctoral researchers from diverse research groups to share ideas. Another important outreach resource for graduate students and postdoctoral researchers would be a career advising office. This resource could also provide information on various funding sources, and how and where to apply for various grants. An important outreach component is the training of scientists who will go on to other universities and talk highly of the College and UC Davis – it is therefore important to make their experience here as worthwhile as possible.

2) **Students outside the College.** Increasing the enrollment in certain College majors will require communication with students currently not enrolled in the College to make them aware of the opportunities and advantages inherent in each of the majors offered by CBS. This goal overlaps with the goals of each of the Departments, and the role of the College should be to encourage and assist the Departments in their efforts to publicize each of their majors to non-College students. Other than participation in events such as Summer advising and Picnic Day, there have been only limited efforts by the College and the Departments to aggressively recruit students to transfer into our majors (e.g., advertising signs in the windows of Briggs Hall, sporadic informational presentations advertised on fliers). It is possible to make greater efforts of this type, perhaps targeting specific interest groups (e.g., pre-meds or students interested in biotechnology or genomics).

One of the most effective mechanisms for attracting non-majors to College majors is the offering of new large-enrollment courses for non-majors, focusing on topics that demonstrate the most exciting and interesting aspects of the research disciplines represented in the College. The courses should be taught by our most talented, enthusiastic and charismatic faculty members. Such courses have been very effective in the past in raising the interest of participants to enroll in College majors, and serve the additional purpose of increasing the total number of students enrolled in courses taught by College faculty. The existence of such courses should be widely advertised in venues visible to both students and the advising staff of non-College majors.

c. **Outreach to the University administration.** Outreach in this category already occurs through standard reports of statistical data (grant income, etc.) provided by the College to the central
administration, as well as periodic reports by the Dean to various administrative bodies. A suggestion for improvement in this area would be creation of an organized and more formal mechanism for collecting information regarding particularly notable accomplishments by College faculty. For example, a record should be kept of every cover article published by a member of the College during the year, or every example where a College faculty member attracts the attention of the national press. These accomplishments should be transmitted to the administration at regular intervals to keep them abreast of the research accomplishments of the faculty. A specific suggestion with respect to publications is that CBS includes, as part of its web site, a link providing a continuously updated Medline-based record of all research publications of College faculty, which might serve as an additional source for documenting the quality of the research done by CBS faculty to the administration.

A critical area in which there is much room for improvement is in the communication of success in acquisition of extramural funding. Most extant reports on campus provide a confusing array of total costs, direct costs, funding sources providing full indirect cost recovery and others providing no or only partial recovery, and most aggregate the data in such a way that it is difficult to identify and quantify the success of individual faculty rather than total funding for indeterminate numbers of faculty. We are committed to doing a better job of accurately tracking and reporting the success of our faculty in this important metric of research success.

d. Outreach to faculty outside of the College. Many interactions between faculty of the College and those in other units occur in a spontaneous manner or through extant entities such as the Graduate Groups and University committees. To develop additional ties and to encourage familiarity with the research of our colleagues outside of the College, we should encourage the participation of relevant faculty as speakers in the College seminar series or at College retreats.

e. Outreach to the faculty of the College. Outreach to faculty within CBS should involve the development of tangible opportunities for direct faculty interactions, such as College seminars and chalk talks, as well as more aggressive use of electronic resources (web site, email newsletters) for disseminating information about research activities within the College. One suggestion is that there should be an annual one-day College-wide poster session, with all labs expected to contribute a poster describing their research program.

With respect to teaching, there will be a continuing need for close cooperation between the College and the Departmental curriculum committees, as curricular revisions of the core are implemented. For this purpose, we have established the LDCCC (lower division core curriculum committee) to coordinate the implementation of curricular revisions that transcend Departmental boundaries. This committee will serve as the guiding body for ensuring that the goals of the new core are implemented, sustained, and well coordinated.

4. Metrics of Success

a. Outreach to communities outside of the university. An effort should be made to determine whether the number of faculty and students participating in outreach activities is changing substantially from year to year. Reports in the written and broadcast media about College faculty should be recorded and displayed on the CBS website, and faculty should be regularly encouraged to bring examples of such events to the attention of the CBS office. The success of these efforts will be measured by an increase in the number of such reports. Income from extramural sources will provide an indirect assessment of the success of outreach to funding agencies, and the quantity of funds raised from private donors will be a
measure of success in outreach to the friends of the College. Faculty outreach efforts associated with the AES are described elsewhere in this plan.

b. Outreach to students.

1) Students within CBS. A tangible measure of success in outreach to students in the College is the enrollment and retention rate of students within each major and within the College. Mechanisms to track these data on an annual basis should be established, and attempts should be made to determine the underlying causes of any significant changes. The success of post-graduation outreach efforts would be measured by the percentage of graduates still in communication with the College at various time intervals after they leave campus.

2) Students outside of CBS. Success in this aspect of outreach will be measured by the increased recruitment of students into selected College majors, and increased enrollment of non-College majors in College courses.

b. Outreach to the University administration. Success in outreach to the upper administration will be measured in the degree to which the College and campus can agree on appropriate and adequate levels of resource allocation commensurate with the success of the faculty of the College in establishing strong research programs and in providing outstanding and innovative (and expensive) educational opportunities to large numbers of students.

c. Outreach to faculty outside of CBS. The complexity and variety of collegial interactions creates difficulties for establishing quantitative measurements of success in this area of outreach. As with internal outreach, one quantifiable measure at the level of research would be the number of jointly authored publications or collaborative research grants. Likewise, joint teaching of courses at the graduate or undergraduate levels might be used as a measure of collegiality in curricular issues.

d. Outreach to faculty within CBS. The success of outreach efforts among faculty within the College can be measured in part by enumerating changes in tangible manifestations of research cooperation, e.g. jointly authored publications and efforts to obtain coordinated research funding such as program project and training grants. A mechanism for collecting such data in a comprehensive manner should be established. With respect to teaching, the creation of a revised core curriculum acceptable to the faculty of the College provided a key measure of the success of internal outreach efforts, and we anticipate more curricular and pedagogical innovations in the five years ahead.
APPENDICES

Appendix IA:

College of Biological Sciences: Expenditure History

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Dollars in Millions
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<th>Fiscal Year</th>
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Note: does not include Federal FlowThrough
Appendix IIA.

College of Biological Sciences Commencement Ceremony
June 18, 2000 Awards

College of Agricultural & Environmental Sciences Medal
Sara Ruth Williams, recipient
(College of Biological Sciences major)

College of Letters & Science
Leon Mayhew Award
Dominic Rachel Dawson, recipient
(College of Biological Sciences major)

College of Letters & Science
Lawrence J. Andrews Prize
Dominic Rachel Dawson, recipient
(College of Biological Sciences major)

Biological Sciences Undergraduate Student of the Year Award
Heather Anne Foley, Recipient
(College of Biological Sciences major)

College of Biological Sciences Commencement Ceremony
June 20, 2001 Awards

Biological Sciences Undergraduate Student of the Year Award
Naileshni Sanjinita Singh, Recipient
(College of Biological Sciences major)

College of Biological Sciences Commencement Ceremony
June 15, 2002 Awards

Chancellor’s Award for Excellence in Undergraduate Research
Nicole Anne Tetreault, Recipient
(College of Biological Sciences major)

Herbert A. Young Award – Letters & Science College Medal
Eon Joseph Rios, Recipient
(College of Biological Sciences major)

Mary Jeanne Gilhooly Award
Huma Javed, Recipient
(College of Biological Sciences major)
Lawrence J. Andrews Prize
Samuel Young-Woo Park, Recipient
(College of Biological Sciences major)

Biological Sciences Undergraduate Student of the Year Award
Patricia Lam Duong, Recipient
(College of Biological Sciences major)

**College of Biological Sciences Commencement Ceremony**
**June 14, 2003 Awards**

Chancellor’s Award for Excellence in Undergraduate Research
Nathan Bronson, Recipient
(College of Biological Sciences major)

Herbert A. Young Award – Letters & Science College Medal
Parmbu Singh Sandhu, Recipient
(College of Biological Sciences major)

Mary Jeanne Gilhooly Award
Beena A. Kavi, Recipient
(College of Biological Sciences major)

Mary Regan Meyer Prize
Mami Shindo, Recipient
(College of Biological Sciences major)

Knowles A. Ryerson Award
Mami Shindo, Recipient
(College of Biological Sciences major)

Biological Sciences Undergraduate Student of the Year Award
Shannon M. Smith, Recipient
(College of Biological Sciences major)

**College of Biological Sciences Commencement Ceremony**
**June 18, 2004 Awards**

Chancellor’s Award in Undergraduate Research
Andreas H. Ehrensberger, Recipient
(College of Biological Sciences major)

University Medal
Jaclyn Keegan Pasko, Recipient
(College of Biological Sciences major)
College of Agricultural and Environmental Sciences College Medal
Nicholas Coley, Recipient
(College of Biological Sciences major)

Herbert A. Young Award – Letters & Science College Medal
Ryan Martin, Recipient
(College of Biological Sciences major)

Charles E. Hess Award
Raj S. Kullar, Recipient
(College of Biological Sciences major)

Mary Regan Meyer Prize
George Bruque, Recipient
(College of Biological Sciences major)

Biological Sciences Undergraduate Student of the Year Award
Cyrus Emil El Saieh Taghavi, Recipient
(College of Biological Sciences major)

College of Biological Sciences Commencement Ceremony
June 17, 2005 Awards

University Medal
Christopher R. Jones, recipient
(Biochemistry and Molecular Biology)

V. Glenn Winslow Jr. Award
Christopher R. Jones, recipient
(Biochemistry and Molecular Biology)

Knowles A. Ryerson Award in Agriculture
Yevgeniy V. Sychev, recipient
(Biochemistry and Molecular Biology)

Mary Regan Meyer Prize
Danielle Marie Chan, co-recipient
(Neurobiology, Physiology and Behavior)

Nicole Rahnea Sunseri, co-recipient
(Micribiology)

Biological Science Undergraduate Student of the Year
Nicole Rahnea Sunseri, recipient  
(Microbiology)

College of Biological Sciences Commencement Ceremony  
June 16, 2006 Awards

University Medal  
Yoel Eli Stuart, recipient  
(Evolution and Ecology)

Herbert A. Young Award - Letters & Science College Medal  
Sarah Elizabeth Albritton, recipient  
(Cell Biology)

College of Agricultural and Environmental Sciences College Medal  
Chi Viet  
(Biological Sciences)

Charles E. Hess Award in Agriculture  
Samia Abdul Ghaffar, recipient  
(Biochemistry and Molecular Biology)

Mary Jeanne Gilhooly Award  
Kirstin Marie Woody, recipient  
(Classical Civilizations / Neurobiology, Physiology and Behavior)

Howard Walton Clark Prize in Plant Breeding and Soil Building in Agriculture  
Elizabeth Huerta Ortiz, recipient  
(Plant Biology)

Biological Sciences Undergraduate Student of the Year  
Yoel Eli Stuart, recipient  
(Evolution and Ecology)

College of Biological Sciences Commencement Ceremony  
June 15, 2007 Awards

University Medal  
Ashley Margaret Heers  
(Evolution, Ecology and Biodiversity / Geology)

Chancellor’s Award for Excellence in Research  
Gregory A. Ho, recipient  
(Biochemistry and Molecular Biology)
V. Glenn Winslow Jr. Award
Matthew Siri, recipient
(Microbiology)

Ronald and Lydia Baskin Research Award
Edgar Ivan Sanchez
(Biomedical Engineering)

College of Biological Sciences Medal
Erin Lynn Richman, recipient
(Biological Sciences)

College of Biological Sciences Undergraduate Student of the Year
Jennifer Yuhas, co-recipient
(Neurobiology, Physiology and Behavior)

Eisha B. Zaid, co-recipient
(Genetics)

College of Biological Sciences Commencement Ceremony
June 13, 2008 Awards

Chancellor’s Award for Excellence in Undergraduate Research
Marisa S. Goo, recipient
(Neurobiology, Physiology and Behavior)

Ronald and Lydia Baskin Research Award
Amanda Caroline Kohler, recipient
(Biochemistry and Molecular Biology)

Charles E. Hess Community Service Award in Agriculture
Christopher r. Fortenbach, recipient
(Biochemistry and Molecular Biology)

College of Biological Sciences College Medal
Matthew L. Tamplen, recipient
(Biochemistry and Molecular Biology)

College of Biological Sciences Undergraduate Student of the Year
Christina Marie Kopriva, recipient
(Neurobiology, Physiology and Behavior)
Appendix IIB:

FACULTY HONORS AND AWARDS

Members and Fellows of Major Academies

National Academy of Sciences
G. Ledyard Stebbins, Professor Emeritus (Genetics) – 1952
Peter R. Marler, Professor Emeritus (Zoology) – 1971
Emanuel Q. Epstein, Professor Emeritus (PLB) – 1978
Paul K. Stumpf, Professor Emeritus (MCB) – 1978
Melvin M. Green, Professor Emeritus (MCB) – 1980
Thomas W. Schoener, Distinguished Professor (EVE) – 1984
John Roth, Distinguished Professor (MIC) – 1988
Eric E. Conn, Professor Emeritus (MCB) – 1988
J. Clark Lagarias, Professor (MCB) – 2001
Deborah Delmer, Professor Emeritus (PLB) – 2004
Edward J. Jones, Distinguished Professor (NPB) and director (Center for Neuroscience) – 2004
Roy H. Doi, Distinguished Professor Emeritus (MCB) – 2006
Stephen Kowalczykowski, Distinguished Professor (MIC) - 2007

French National Academy of Sciences
William J. Lucas, Distinguished Professor and chair (PLB) - 2000

American Academy of Arts and Sciences
Peter R. Marler, Professor Emeritus (Zoology) – 1970
Thomas W. Schoener, Distinguished Professor of biology (EVE) – 1991
Stephen Kowalczykowski, Distinguished Professor (MIC) – 2005
Michael Turelli, Professor (EVE) – 2005
Charles Langley, Distinguished Professor (EVE) - 2007

American Association for the Advancement of Science (Fellows)
Frederick T. Addicott, Professor Emeritus (PLB)
Judy Callis, Professor (MCB)
Leo M. Chalupa, Distinguished Professor and chair (NPB)
Ernest S. Chang, Professor (NPB)
Peter Chesson, Professor (EVE)
James S. Clegg, Professor Emeritus (MCB)
John H. Crowe, Professor Emeritus (MCB)
Michael Dahmus, Distinguished Professor (MCB)
Roy H. Doi, Distinguished Professor Emeritus (MCB)
Emanuel Q. Epstein, Professor Emeritus (PLB)
Carol Erickson, Professor (MCB) and Executive Associate Dean
Charles Gasser, Professor (MCB)
Leslie D. Gottlieb, Professor Emeritus (EVE)
John Harada, Professor (PLB)
Milton Hildebrand, Professor Emeritus (EVE)
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and interim Provost
Edward G. Jones, Distinguished Professor (NPB) and director (Center for Neuroscience)
Stephen Kowalczykowski, Distinguished Professor (MIC)
William J. Lucas, Distinguished Professor and chair (PLB)
Peter R. Marler, Professor Emeritus (Zoology)
Richard Michelmore (MCB) and director, UC Davis Genome Center
Brian C. Mulloney, Professor (NPB)
Diana Myles, Professor (MCB)
Richard L. Nuccitelli, Professor Emeritus (MCB)
Timothy G. Prout, Professor Emeritus (EVE)
Carl Schmid, Professor Emeritus (MCB)
Irwin Segel, Distinguished Professor (MCB)
Arthur M. Shapiro, Professor (EVE)
Neelima Ray Sinha, Professor (PLB)
Judy A. Stamps, Professor (EVE)
Donald R. Strong, Distinguished Professor (EVE)
Paul K. Stumpf, Professor Emeritus (MCB) (deceased)
John S. Werner, Professor (NPB)
Susan Williams, Professor (EVE) and director, Bodega Marine Laboratory
Martin C. Wilson, Professor (NPB)

California Academy of Science (Fellows)
James A. Doyle, Professor (EVE)
Peter R. Marler, Professor Emeritus (Zoology)
Arthur M. Shapiro, Professor (EVE)
Maureen Stanton, Professor and chair (EVE)
Catherine A. Toft, Professor (EVE)
Susan L. Williams, Professor (EVE and Bodega Marine Lab)

Selected Distinguished Awards and Fellowships

Fellow of the Royal Society
Peter R. Marler, Professor Emeritus (Zoology) – 2008

National Medal of Science
G. Ledyard Stebbins, Professor Emeritus (Genetics) – 1979

NSF Presidential Young Investigator Award
Charles Gasser, Professor (MCB) – 1990
Judy Callis, Professor (MCB) – 1991

Presidential Early Career Award for Scientists and Engineers
W. Martin Usrey, Associate Professor (NPB) and Center for Neuroscience – 2001
William DeBello, Assistant Professor (NPB) and Center for Neuroscience – 2004

Alfred P. Sloan Research Fellowship
Kimberley McAllister, Associate Professor (NPB) and Center for Neuroscience – Neuroscience, 2001
Martin Usrey, Associate Professor (NPB) and Center for Neuroscience – Neuroscience, 2001
Hwai-Jong Cheng, Associate Professor (NPB) and Center for Neuroscience – Neuroscience, 2004

John Simon Guggenheim Memorial Fellow
Robert E. Hungate, Professor Emeritus (MIC) – 1950
Daniel I. Axelrod, Professor Emeritus (Botany) – 1952
Ledyard Stebbins, Professor Emeritus – 1953, 1960
John Tucker, Professor Emeritus (Botany) – 1955
Melvin M. Green, Professor Emeritus (MCB) – 1956, 1968
Everett Williams Jameson, Jr, Professor Emeritus (Zoology) – 1958
Peter R. Marler, Professor Emeritus (Zoology) – 1964
Grady Webster, Professor Emeritus (Botany) – 1964
John Lyman Ingraham, Professor Emeritus (MIC) – 1965
Norma J. Lang, Professor Emeritus (Botany) – 1969
Jerry Hedrick, Professor Emeritus (MCB) – 1971
Paul Alexander Castelfranco, Professor Emeritus (Botany) – 1973
Leslie D. Gottlieb, Professor Emeritus (EVE) – 1975
Leo M. Chalupa, Distinguished Professor and chair (NPB) - 1978
Michael Turelli, Professor (EVE) – 1986
Carl Schmid, Professor Emeritus (MCB) – 1988
Thomas W. Schoener, Professor (EVE) – 1992

Kimmel Scholars Award
Ken Kaplan, Associate Professor (EVE) – 2001

The Pew Charitable Trusts
Kenneth H. Britten, Professor (NPB) and Center for Neuroscience – 1994 Pew Scholar in the Biomedical Sciences
Kimberley McAllister, Associate Professor (NPB) and Center for Neuroscience – 2001 Pew Scholar in the Biomedical Sciences

Bodil M. Schmidt-Nielsen Distinguished Mentor and Scientist Award
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and interim Provost – 2007

Recipients of Major Campus Awards

UC Davis Academic Federation Excellence in Teaching Award
Tom Adamson, lecturer (NPB) – 1996
Deborah Canington, academic coordinator and lecturer (PLB) – 1998
Susan Keen, Senior Lecturer SOE (EVE) – 2006
Erwin Bautista, lecturer (NPB) – 2007
James Shaffrath, lecturer (NPB) - 2008

UC Davis Academic Federation – James H. Meyer Distinguished Achievement Award
Martina Newell-McGloughlin, director UC Davis Biotechnology Program – 2001
Carole Hom, academic coordinator (EVE) – 2005

**UC Davis Academic Senate Distinguished Teaching Award**
Michael G. Barbour, Professor Emeritus (Botany) – 1988
Ernest M. Gifford, Professor Emeritus (Botany) – 1986
G. Ledyard Stebbins, Professor Emeritus (Genetics) – 1972
Eric E. Conn, Professor Emeritus (Biochemistry and Biophysics) – 1974
Milton Hildebrand, Professor Emeritus (Zoology) – 1974
Robert M. Thornton, Senior Lecturer Emeritus (Botany) – 1975
Robert D. Grey, Professor Emeritus (Zoology) and provost and executive vice chancellor – 1978
Barbara A. Horwitz, Distinguished Professor Emeritus (Animal Physiology) and interim Provost – 1982
John M. Horowitz, Professor Emeritus (Animal Physiology) – 1988
Arthur M. Shapiro, Professor (EVE) – 1990
Arnold J. Sillman, Professor Emeritus (NPB) – 1995
Thomas L. Rost, Professor Emeritus (PLB) – 1997
Richard Grosberg, Professor (EVE) – 2002
Charles Gasser, Professor (MCB) – 2006, undergraduate
John Harada, Professor (PLB) – 2007
Peter Wainwright, Professor (EVE) – 2008, undergraduate
Roy Doi, Distinguished Professor Emeritus (MCB) – 2008, graduate

**UC Davis Academic Senate Distinguished Scholarly Public Service Award**
H. Bradley Shaffer, Professor (EVE) - 2006

**UC Davis Academic Senate Faculty Research Lecturer**
Robert Hungate, Professor Emeritus (MIC) – 1967
Thomas Schoener, Professor (EVE) – 1994
Peter R. Marler, Professor Emeritus (Zoology) – 1995
Stephen Kowalczykowski, Distinguished Professor (MIC) - 2005

**UC Davis Chancellor’s Award for Excellence in Undergraduate Research**
Merna R. Villarejo, Professor (MIC) – 1994
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and interim Provost – 1995
R. Scott Hawley, Professor (MCB) – 1997
Terence M. Murphy, Professor (PLB) – 1999
Neelima Sinha, Professor (PLB) - 2001

**UC Davis Chancellor’s Fellows**
Wolf Dietrich Heyer, Professor (MIC) – 2000-05
Michael Sanderson, Professor (EVE) – 2000-05
Jodi Nunnari, Professor (MCB) – 2001-06
Sharon Strauss, Professor (EVE) – 2002-07
John Bowman, Associate Professor, (PLB) – 2003-08
Sergey Nuzhdin, Associate Professor (EVE) – 2004-2009
Edmond (Ted) Powers, Associate Professor (MCB) – 2005-2010
David Begun, Professor (EVE) – 2005-2010
John “Jay” Stachowicz, Associate Professor (EVE) – 2006-2011
Kimberley McAllister, Associate Professor (NPB) – 2007-2012

UC Davis Prize for Undergraduate Teaching and Scholarly Achievement
Eric E. Conn, Professor Emeritus (Biochemistry and Biophysics) – 1989
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and interim Provost – 1991
Maureen Stanton, Professor (EVE) – 2005

UC Presidential Award for Excellence in Fostering Undergraduate Research
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and interim Provost – 1995

Recipients of Major College/Division Awards

College/Division of Biological Sciences Faculty Teaching Award
Richard Grosberg, Professor (EVE) – 2000-2001
Bradley Shaffer, Professor (EVE) and director, Center for Population Biology – 2001-2002
Terry Murphy, Professor (PLB) – 2002-2003
Charles Gasser, Professor (MCB) – 2004-2005
Mark Wheelis, Senior Lecturer SOE Emeritus (MIC) – 2006-2007
James Shaffrath, Continuing Lecturer (NPB) – 2007-2008

Novozymes Biotech, Inc. Endowed Chair in Genomics
Richard Michelmore, Professor (MCB) and director, UC Davis Genome Center – 2004-2009

Paul K. and Ruth R. Stumpf Professorship in Plant Biochemistry
J. Clark Lagarias, Professor (MCB) – 2000-2005
Judy Callis, Professor (MCB) – 2005-2010

Endowed Chair in Physiology
John Wingfield, Professor (NPB) – 2007-2012

Recipients of Society Awards and Honors

American Academy of Microbiology Fellows
Paul Baumann, Professor (MIC)
Steven Kowalczykowski, Distinguished Professor (MIC)

American Association of Anatomists
Martin Usrey, Associate Professor (NPB) – 2001 Charles Judson Herrick Award

American Philosophical Society
Edward G. Jones, Distinguished Professor (NPB) and director (Center for Neuroscience) – 2001 Spencer Lashley Award
American Physiological Society
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and interim Provost – 1996 Arthur C. Guyton Physiology Teacher of the Year

American Society of Plant Biologists Early Career Award
Simon Chan, Assistant Professor (PLB) – 2006

American Society of Plant Physiologists Fellow
William J. Lucas, Distinguished Professor and chair (PLB) – 2007

American Society of Plant Physiologists Martin Gibbs Medal
William J. Lucas, Distinguished Professor and chair (PLB) – 1997

Australian Society of Plant Physiologists Honorary Life Member
William J. Lucas, Distinguished Professor and chair (PLB) – 1994

Botanical Society of America
Leslie Gottlieb, Professor Emeritus (EVE) – 2000 Merit Award

Endocrine Society
Phyllis M. Wise, Distinguished Professor (NPB) – 2003 Roy O. Greep Award Lecture

Federation of American Societies in American Biology
Phyllis M. Wise, Distinguished Professor (NPB), Award for Excellence in Science

Francqui Medal of the Belgian Francqui Foundation
William J. Lucas, Distinguished Professor and chair (PLB) – 2001

Genetics Society of America Medal
Charles H. Langley, Distinguished Professor (EVE) – 1999

Society for Neuroscience Young Investigator of the Year Award
Kimberley McAllister, Associate Professor (NPB) and Center for Neuroscience – 2006

Recipients of Other Awards and Honors

Beckman Foundation Award for Young Investigators
John Bowman, Associate Professor (PLB) – 1998
Sean Burgess, Assistant Professor (MCB) -- 2000

Damon Runyon Cancer Research Foundation
Neil Hunter, Assistant Professor (MIC) – 2004 Scholar Award

Ellison Medical Foundation
Phyllis M. Wise, Distinguished Professor (NPB) – 2001 Senior Scholar in Aging
Su-Ju Lin, Assistant Professor (MIC) – 2004 New Scholar in Aging Award
Esther A. and Joseph Klingenstein Fellowship Award
Gregg Recanzone, Associate Professor (NPB) and Center for Neuroscience – 1996
Martin Usrey, Assistant Professor (NPB) and Center for Neuroscience – 2000
Hwai-Jong Cheng, Associate Professor (NPB) and Center for Neuroscience – 2004

Hellman Family Foundation
Karen Zito, Assistant Professor (NPB) – 2008 Hellman Fellow
Simon Chan, Assistant Professor (PLB) – 2008 Hellman Fellow

John Merck Scholarship
Kim McAllister, Associate Professor (NPB) – 2003 Biology of Developmental Disabilities in Children Award

Jules and Doris Stein Professorship Award
Jack Werner, Professor (NPB) – 2000

Kimmel Scholars Award
Ken Kaplan, Associate Professor (EVE) – 2001

March of Dimes Basil O'Connor Award
Frederic Chedin, Assistant Professor (MCB) – 2005
Daniel Starr, Assistant Professor (MCB) – 2005
Neil Hunter, Assistant Professor (MIC) – 2005

McKnight Endowment Fund for Neuroscience
W. Martin Usrey, Associate Professor (NPB) – 2002-2004

NIH Merit Award
Barbara A. Horwitz, Distinguished Professor (Animal Physiology) and Interim Provost – 1992
Steve Kowalczynowski, Distinguished Professor (MIC) – 2001
John S. Werner, Professor (NPB) – 2001
Martin Privalsky, Professor (MIC) – 2002

NSF Program Directorship
Sharman O’Neill, Professor, (PLB) – 2000-01
Sharon Strauss, Professor (EVE) – 2001-01

Philip Hamm Lectureship Award
Deborah Delmer, Professor Emeritus (PLB) – 2001

Searle Scholar
Kenneth Burtis, Professor (MCB) and Dean – 1990-1993
Gregg B. Morin, Assistant Professor (MCB) – 1993-1996
Appendix III.

A. Student enrollment in BIS 1 A-B-C series

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B. CBS Enrollment Growth

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<td>Fall 2007</td>
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</table>

*Microbiology Graduate Group moved to the School of Medicine
Appendix IV.

PROPOSAL FOR A CBS RESEARCH HONORS PROGRAM
8 April 2003

Approved: CBS Curriculum Committee (with changes) 18 March
CBS Administrative Advisory Committee 8 April

Overview

We propose that CBS initiate an Honors Research Program for its highest achieving students. Admission to the program would be by invitation, offered to freshman applicants on the basis of their high school grade point average (GPA) and test scores, and to UC Davis sophomores on the basis of their freshman year GPA. Continuance in the program would require continued high-level achievement. Completion of the program would be noted on the student’s transcript.

The program would revolve around a year or more of laboratory research in the junior year, leading to a senior thesis. We believe that our best students, whether their career plans include research or not, will benefit greatly from this extended research experience. Only by participating in the generation of new knowledge does one come to fully understand the nature and limits of the knowledge we already have.

For high-caliber students, this program would be an opportunity to pursue research in state-of-the-art facilities and to discuss scientific problems and solutions over several years with faculty mentors and peers. For faculty, this program is an opportunity to mentor students of the highest caliber and motivation.

Goals

This program is intended to enrich the academic experience of our highest achieving students by

Encouraging sustained engagement in research. Regardless of post-graduate career choice, active engagement in original research can greatly enrich the educational experience; one of the goals of this program is to encourage more of our best students to participate for multiple quarters.

Encouraging synthetic thought, understanding of intellectual context, and accurate, thorough data analysis. The requirement for an honors thesis for completion of the Honors Research Program complements the research requirement by requiring the student to write up the results of his/her experimental work, fostering a better understanding of the importance, context, and meaning of the results

Encouraging discussion and interaction. Much of the learning process is in peer interactions, and one of the goals of the Honors Research Program is to foster this interaction by dedicated, small enrollment seminar courses restricted to honors students.
In addition to the benefits for student participants, it is anticipated that the campus and College will benefit by a higher “take-rate” among admitted high-achieving applicants. The program is expected to be an inducement to attend UC Davis rather than other campuses to which they are admitted. The faculty will also benefit from the opportunity to work closely with these students in the laboratory and in seminar courses.

**Admission Standards**

Admission to the program is by invitation only to high school applicants that have SAT and ACT scores of at least 1250 and 30 respectively, a high school GPA of at least 3.70, and a brief essay that demonstrates, to the satisfaction of an Admissions Committee, interest and motivation that are suitable to our Honors Research Program. Among applicants for admission in fall 2002, 234 met the GPA and test criteria above. Since UC Davis has a “take rate” of 32%, the stated criteria would yield a maximum of 75 students (probably considerably fewer would actually accept, as the take rate is considerably less than the average for this group of applicants). For the first year or two, we would expect to offer considerably fewer than 200 spaces in the honors program, to start out with a smaller group.

A second entry point into the Honors Research Program will be at the end of the freshman year. Qualified students will be evaluated on their performance in the freshman year (including GPA over 3.50 and satisfactory progress in the major).

Students must maintain a minimum GPA of at least 3.50 to remain in the program. Any student falling below the standard will be placed on a one-quarter probationary period and given the following quarter to return to good standing in the program. If the GPA is not raised to the minimum, the student will be dropped from the program.

At graduation all honors student will receive special recognition and transcript notation.

**Honors Research Program Outline**

We recommend the Honors Research Program be implemented immediately (i.e., for the class entering in 2003), consisting of the following components:

1. **Freshman seminar.** Each freshman honors student and each newly admitted sophomore honors student will complete one honors freshman seminar. Seminars will be research oriented, 1-2 units, letter graded. They will be restricted to honors students.

2. **Orientation to research.** In their sophomore year, students will take an orientation seminar, in which faculty interested in supervising honors students would give brief presentations of their work, and the research methods they use. This would help students understand the range of research in CBS and related units, and familiarize them with the methods used to address different scientific problems. The orientation would be 2 units, P/NP graded, in the spring quarter. Freshman honors students would be allowed to take the seminar on a space available basis.

3. **Research.** Each honors student will begin undergraduate research no later than the beginning of the junior year, and will continue for a minimum of one year. The CBS Dean’s office will help place students
in research labs. Students will enroll in a minimum of 3 units of 199 per quarter. Research may, by agreement between the student and faculty sponsor, continue beyond the junior year.

4. **Graduate course or seminar.** Each student would be encouraged to take at least one graduate seminar related to his or her research field.

5. **Presentation of research results.** Each honors student will present the results of their research at least once at the Undergraduate Research Conference, or other appropriate venue.

6. **Senior thesis.** Each honors student will write their research results up as a senior thesis.

7. **Capstone course.** Each honors student will take a senior seminar course in which they present a “portfolio” of their work, including their honors thesis and an analysis of their own curriculum. The course will be 2 units, P/NP graded. Appendix 1 describes this course.

**Administrative issues**

The proposed program would, as far as we can tell, require no legislative or by-law changes. As the CBS Honors Committee we would assume the necessary oversight role. The committee chair would assume the role of faculty coordinator, who would work with the Associate Dean of CBS, and with the honors committee, on implementation and administrative matters, and would have responsibility to coordinate the research orientation course. This represents a commitment of instructional time (2 units) that should count towards the committee chair’s normal teaching load. Staff support will be provided by CBS.

The program is independent of college honors, and participating students would continue to earn college graduation honors as in the past: by GPA alone in A&ES, and by GPA and senior thesis in L&S. We expect that most, if not all, of the students in the program would qualify for at least honors, and many should qualify for high or highest honors.

Participation in this program will require students to take at least one freshman seminar (1-2 units), research orientation (2 units), a year or more of research (9+ units), the senior thesis (2 units), and the capstone course (2 units). Thus, students would be committing approximately 17 units to the program. This should not be a hardship, as students must take a minimum of 180 units to graduate. With 110 units required for a BS degree, 24 for general education, and 8 for composition, all students must take about 40 or so units beyond the minimal curricular requirements. The 17 required for this program should be easily accommodated, albeit at the expense of some exploratory opportunities. Since these units are program requirements, not major requirements, they are not subject to the L&S limitations on the number of units that can be required by majors.

**Comparison to Other Institutions**

Many other institutions have honors programs of one sort or another. Appendix 2 summarizes state university honors programs. These cover a wide range. Some simply require a certain number of honors courses spread over four years (e.g., Michigan State, University of New Mexico, University of Utah). Most have a specific requirement for research and a senior thesis, or students transfer into departmental
honors programs in which such requirements are embedded. The program we propose is comparable to most of these. It is structurally similar in its requirement for honors courses, significant engagement in research, and a senior thesis. It is lighter than the average in its course requirements (mainly because at UC Davis we do not have a range of designated honors courses), but it has some unique features that distinguish it, such as the orientation to research and capstone courses.

The admissions and retention standards we propose are comparable to those at other institutions as well. Qualifying high school grade point averages range from 3.2 to 3.8, SAT scores from 1100 to 1340 (with one outlier requiring only 900), and ACT scores 27 to 32. Retention grade point averages range from 3.0 to 3.5.

A number of programs have a residential component, with dedicated dorms or floors on dorms for their honors students. This feature merits consideration for our program.

**CBS Honors Committee:**

- Peter Armstrong
- David Begun
- Andrew Ishida
- Bo Liu
- Mark Wheelis, Chair
Appendix V.

College of Biological Sciences, University of California, Davis
Agricultural Experiment Station Outreach Plan

Rationale
Most faculty in the College of Biological Sciences (CBS) and the College of Agricultural & Environmental Sciences (CA&ES) hold fiscal-year appointments split between the Instruction & Research (I&R) and Agricultural Experiment Station (AES) components of the University. About 100 faculty members (34 CBS and 67 CA&ES) hold fiscal-year term (FYT) AES appointments that are subject to periodic review and renewal. In November 2002, the Chancellor designated the AES Associate Director as "responsible for conducting reviews of the AES component of faculty holding FYT appointments." In the first two rounds of review, concerns were raised about the AES mission-oriented outreach activities for 11 of the 13 of the CBS faculty members reviewed. Each therefore was required to submit a "brief mid-term update and progress report on [their] successes at identifying and connecting with appropriate outreach clientele … " Therefore, FYT appointees are advised that documenting satisfactory outreach activity may be important for future reappointment to the AES.

Faculty outreach in general is attracting increased interest. For example, the National Science Foundation requires that grantees address the "broader impacts" of their proposed research, including evidence for broad dissemination of results and benefits to society. Likewise, the UC Davis Strategic Plan lists faculty "engagement" as one of three goals, along with "learning" and "discovery." Future evaluation of academic units will include reviews of progress toward these goals. Thus, faculty documentation of AES mission-oriented outreach activities can help to satisfy expectations in arenas beyond the AES per se. Faculty performance in the AES is evaluated in accordance with the Academic Personnel Manual, section UC Davis-320, Appointment and promotion of agronomists in the AES series. UCD-320 includes Exhibit A, Evaluating split appointments: Agronomist (_____ in the Agricultural Experiment Station) with a professorial title. Excerpts are presented in APPENDIX A below.

The AES outreach plan presented here outlines some of the ways in which CBS faculty can fulfill and document their AES mission-oriented outreach obligations. It is anticipated that individual faculty members will participate in a wide variety of mission-oriented outreach activities that are not specifically mentioned in this document. (NOTE: Several phrases below have been excerpted or paraphrased from UC Davis-320.)

Individual Mission-Oriented Research and Outreach Plans (Hatch Proposals)

An individual's AES mission-oriented research is described in his or her AES (Hatch) project, which is subject to renewal every five years. Hatch projects are approved and reviewed by the academic unit, the UC Division of Agricultural and Natural Resources (DANR), and the U.S. Department of Agriculture. This Hatch project serves as a basis for reviewing progress and accomplishment. The approved project description should give a conceptual and specific overview of the expectations for the AES portion of the faculty member's appointment. Therefore, faculty are advised to include an outreach plan in the Hatch proposal, in addition to the research plan. This will serve as an approved, documented standard against which outreach progress and accomplishment can be evaluated.

Identifying Clientele and Stakeholders
Land grant universities are accountable to clientele, many of whom also serve as stakeholders. State Agricultural Experiment Stations and Cooperative Extension Agencies provide a major conduit for fulfilling this mission. Clientele comprises "the clients of a professional person taken collectively," or "a body of customers or patrons," and a stakeholder has "a share or interest in an enterprise, especially a financial share." Stakeholders include governmental agencies; organizations representing California agricultural and business interests; environmental groups; and biotechnology and pharmaceutical firms. These often contract for research programs directed toward specific issues. For example, the program to study Pierce's disease of grapevine has been funded by a broad mix of governmental and nongovernmental agencies. Therefore, mission-oriented research should meet the needs of identifiable clients. What people and processes will benefit from the mission-oriented research? The resulting outreach program will identify appropriate conduits to provide communication for the professional researcher to learn about clients' needs, and to report back the results of mission-oriented research guided by these needs.

**Mission-Oriented Outreach**

Outreach activities may be conducted on or off campus, but will vary by person and/or discipline. Some CBS faculty conduct research that is directly relevant to off-campus clientele. However, much of the mission-oriented research conducted by CBS faculty is very basic and therefore unlikely to directly impact practices in the field. In these cases, outreach involves consultation or collaboration with other AES and non-AES scientists whose work has a more applied focus. Regardless of the exact outreach activities, it is expected that they will be relevant to the mission of the AES (see APPENDIX B).

The primary determinant of outreach is activity that directly or indirectly delivers information to California’s citizens residing outside of the confines of academia. Thus, normal teaching activities involving undergraduate or graduate students, publications in peer-reviewed journals that are targeted for an academic audience and presentations made to one’s academic colleagues at professional society meetings do not constitute outreach that is consistent with the AES mission.

**CBS Mission-Oriented Research in Relation to the AES Mission Statement**

The newly-crafted AES mission statement presents a restricted focus for mission-oriented research (see APPENDIX B). Historically, AES research conducted within CBS has encompassed a broader range of issues that include topics relevant to human health and disease. This research was conducted under the auspices of approved Hatch projects, and was therefore considered as appropriate for the purpose of FYT appointment reviews. However, mission-oriented outreach conducted by CBS faculty must now be targeted specifically at agriculturally important issues relevant to the problems of agriculture in its broadest aspects.

**Examples of CBS Mission-Oriented Outreach Activities**

Listed below are a few representative examples of mission-oriented outreach activities in the context of CBS Hatch projects. Some are responses to an informal survey.

Interacting with officials in local, State and/or Federal governmental agencies:
• Research on Bureau of Land Management (BLM) land under a cooperative agreement, which requires that research results be shared with BLM.
• Meeting with and educating USDA Forest Service personnel about the dependence of the birds we study on National Forest Service lands.

Interacting with officials in local, State and/or national nongovernmental organizations:
• Meeting with agricultural delegations from California Farms Bureau Federation and their national and international guests.
• Participating on task forces to solve specific environmental problems in collaboration with governmental agencies, nongovernmental organizations, environmental consulting firms, and citizen’s groups.

Interacting with private sector companies that have goals in common with the AES:
• Consultant for an agricultural biotechnology company.

Interacting with applied scientists in other units:
• Participant in a DANR workgroup.
• Collaboration with agricultural or environmental scientists in CA&ES.
• Collaboration with clinicians in the schools of Medicine or Veterinary Medicine.

Participating in meetings with the public:
• Research-based presentation and question-answer session for laypeople at an American Cancer Society fundraiser
• Giving lectures to local organizations such as state or local bird clubs, Audubon Society, etc regarding our research and regarding the natural history and conservation of the birds we study.

Publishing articles in popular and trade/industry magazines:
• Writing articles on mission-oriented research in venues such as California Agriculture magazine.

Interacting with the Public:
• Answering telephone and e-mail questions about biological sciences topics.
• Writing to local newspapers (Davis Enterprise and Sacramento Bee) about potential applications of basic research, and hot agriculture-related issues like chicken flu.

Working with public or private schools:
• Arranging for field trips for school groups or scout troops to visit study sites.

Teaching University Extension courses or short courses:
• Presentations in Biotechnology Program seminars or short courses.

Participating in workshops, field tours, or symposia:
• Participation in conferences with broad participation from the agriculture community, e.g. Annual CDFA Pierce's Disease conference where the audience was made of faculty, CDFA staff, grape growers, wine industry people, etc.

Appendix A. Excerpts from the Academic Personnel Manual
Excerpts from UC Davis 320-4 (Series Description):
• AES projects are supported by Federal and State funds earmarked for mission-oriented research, both basic and applied, consistent with the mission of the California Agricultural Experiment Station.
• The AES appointee is expected to disseminate the results of that research, sometimes but not always mediated by Cooperative Extension, to other scientists and to those who can use and benefit directly from the results.
• The AES appointee is expected to provide services to the University and public and private sectors and complement University educational programs both on and off campus.
• It is expected that research will be the dominant activity, providing direction to the other activities of the appointee.

Excerpts from UC D 320-10 (Criteria):
Outreach activities apply research-based expertise to identify issues and communicate solutions to people within the State or society. As such, these activities are derivative of research productivity. Outreach activities could include any of the following at the appointee's discretion:
• Interacting with officials in local, State and/or Federal governmental agencies, with private sector companies that have goals in common with the AES, and/or with Cooperative Extension (Specialists, Advisors, work groups, and programs);
• Participating in meetings with the public;
• Publishing articles in popular and trade/industry magazines;
• Providing information for articles for newspapers, radio, or visual media;
• Developing computer software;
• Working with public or private schools;
• Teaching University Extension courses or short courses;
• Participating in workshops, field tours, or symposia; or other activities.

Appendix B. Mission Statements

The mission of the AGRICULTURAL EXPERIMENT STATION (AES) at the University of California, Davis, is to conduct research that encompasses the continuum of fundamental and applied research for the purpose of developing new knowledge and technologies that ultimately address specific problems of importance to the people of California. Key to this mission is a broad range of research focused on the discovery of solutions and the development of educational programs that disseminate knowledge and technology to an identified clientele. The AES mission focuses on agricultural, environmental, and societal issues that are impacted by, or impact upon, the management of agricultural and natural resource systems. (As of June 2003).

The mission of the COLLEGE OF BIOLOGICAL SCIENCES (CBS) at the University of California, Davis, is:
• To develop and deliver undergraduate programs in the biological sciences of the highest possible quality.
• To contribute significantly to graduate and postdoctoral education in the biological sciences by participating in graduate academic programs and administration.
• To provide an environment for faculty members and students to do original and creative research of the highest quality in the biological sciences.
• To provide service to the campus, the state of California, and the nation through service, outreach, and scientific leadership.

The COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES is a community of scientists and scholars dedicated to excellence in, and the effective integration of, research, education, extension and public service. Major foci of the College are in the areas of agricultural systems; environmental sustainability and ecosystem function; and human health and development. The College partners with the citizens and communities of California to meet contemporary societal needs and provides leadership in developing science-based solutions. In our evolving society, the College continually adapts and changes in both focus and structure, to maintain and to build relevant, innovative and high quality program. (As of January 2004)

The mission of the UNIVERSITY OF CALIFORNIA, DAVIS: Through a distinctive tradition of core-discipline excellence, interdisciplinary collaborations and productive partnerships, UC Davis TEACHES STUDENTS to think critically, objectively and creatively and to be lifelong learners, engaged leaders and productive citizens; PURSUES RESEARCH to advance knowledge and to address state, national and global challenges; and SERVES THE PUBLIC through the generation, broad dissemination and application of knowledge. (Strategic Plan, Fall 2003)